THE DIVINING-ROD.*

BY ROSSITER W. RAYMOND.

The extent to which the divining-rod is still used in this country for the detection of hidden treasure, mineral veins or springs, is much greater than educated persons would be likely to suppose. For many years wells have frequently been located by its aid in New England, where the belief is widely extended among the farmers that in the hands of peculiarly gifted persons this instrument possesses special virtue. Large numbers of the oil wells of Pennsylvania have been bored at points designated by the so-called "oil-smellers." More than one adept with this instrument is practicing now in the Western mining region. I encountered, a few months ago, in Southern Colorado, a party of capitalists who were accompanied by such an expert, and whose purpose was to discover a mine by his aid, and to buy the property thus made valuable. Still more recently a paragraph in the Tombstone *Epitaph*, of Arizona, announced that a party of gentlemen from Chicago, whose names were given, had been scouring over the hills in the neighborhood of Tombstone for more than a week, in company with an expert from Colorado, who had been employed to ascertain "with his well-known divining-rod" the localities of mineral wealth, and who had declared the existence of large bodies of ore in at least two places not yet developed. It is also reported, with what truth I do not know, that the Central Pacific and Southern Railroad companies have employed the divining-rod successfully in the discovery of water, and have located by this means their artesian wells in the desert. Last, but not least, a small book entitled "The Divining-Rod," and published in Cleveland, in 1876, contains an essay on this subject, read before the Civil Engineers' Club of the Northwest, at Chicago, in 1875, by Mr. Charles Latimer, a well-known engineer who has had charge of several important railways, and who testifies in the most unqualified manner to the virtues of the divining-rod as a means of determining the position and the depth of subterranean water-courses, and claims to have discovered certain new and important laws of its operation connecting, if not identifying, it with the force of electricity.

These circumstances, taken together with the fact that the "dowsers," or experts with the rod, still enjoy considerable local authority in Cornwall, and that believers in its efficacy may still be encountered among the German miners (although I think in that country the faith is more nearly extinct than elsewhere), certainly justify me in regarding this subject as one not solely of historical interest. Yet a consideration of its history and literature will throw important light upon the question whether the phenomena which it has presented, and continues to present, are to be ranked under the head of self-delusion, deliberate deceit, or both; or, on the other hand, indicate, after all reasonable deductions for human error and credulity, a residuum of important scientific truth.

Before sketching the history of this instrument it will be well to say a few words concerning its form, material and use. Yet this is a work of no little difficulty. The immense literature of the divining-rod shows nothing more clearly than the boundless confusions and contradictions of its advocates and professors. Of the dozen different schools of practice, each is necessarily obliged to reject half of the asserted principles and certified facts put forward by the rest. The most common divining-rod, perhaps, has always been a forked branch of witch-hazel in the shape of the letter Y. This wood may have been selected because it forks in such a way as to give two branches of equal size, or because of its supposed affinity for springs of water. But other woods, such as peach, ash, pitch-pine, and even metals, have been recommended at different times, and different professors of the art have also varied the shape of the rod, employing sometimes a straight twig with a small fork only at one end, or an elastic twig or whalebone without any fork. The dowsing-rod used by the expert mentioned in the Tombstone *Epitaph*, is, I believe, an instrument made of two prongs of whalebone united in a stem which terminates in a case similar to a rifle cartridge. The contents of this case are a secret. (Similar cases used in the Middle Ages, are said to have contained mercury.) This rod, like the ordinary forked hazel switches, is held in the two hands, each grasping the extremity of a prong, with the fingers closed not too tightly and the palms upward, the shank or stem of the rod being horizontal or vertical, or variously inclined, according to the principles of the practitioner. When carried in this manner by the operator, walking over the surface of the ground, the rod is said to turn or dip above treasure, mineral veins, springs, etc.; but there is an elaborate and complicated science based upon the various degrees, directions and force of this dipping. Unfortunately, the rules as determined by one or another celebrated operator have been found not to work for his rivals or successors, so that each authority lays down rules of its own. The straight rods were either balanced in various ways on one or both hands, or sprung bowlike between the two hands. The most peculiar rod described in ancient books was made of two pieces of wood, one of which was pointed and the other provided in the end with a socket. This rod, being delicately held, was said to indicate the presence of the object sought for by a peculiar revolution of the point in the socket.

An inquiry into the uses of such rods leads us at once to the history of our subject, in the study of which it will appear that divining-rods were first used in antiquity mainly or wholly for moral purposes; that in the Middle Ages their employment was for a long period confined to the discovery of material objects; that toward the end of the seventeenth century the moral use was again asserted, and that in the eighteenth century the divining-rod was relegated to the material sphere, and assumed the comparatively modest functions in the discharge of which it still lingers among us. I would recommend to those who have not the means of an extended research the perusal of the book of Professor Fiske, of Harvard, on "Myths and Myth Makers" (Boston, 1873), in the second essay of which, on "The Descent of Fire," this subject is treated in the light of comparative mythology; also the work of Louis Figuier, "Histoire du Merveilleux dans les Temps Modernes" (Paris, 1860), half of the second volume of which is devoted to the divining-rod; and, finally, the book of Chevreul, "La Baguette Divinatoire" (Paris, 1853), which is a conclusive summary from the standpoint of modern science and experiment. I do not mention the work of Mr. Baring-Gould, "Curious Myths of the Middle Ages," which Professor Fiske compliments with frequent quotations, for the simple reason that Mr. Baring-Gould's essay on the divining-rod is made up almost wholly of portions of Figuier's work, often translated *verbatim* and without credit. A brief, interesting and impartial discussion of the divining-rod from the standpoint of the Middle Ages, together with a curious engraving illustrating its use, will be found in the well-known work of Agricola, "De Re Metallica," (Basle, 1546), published in the sixteenth century both in Latin and in German, copies of which, though not very common, are still to be met with in the antiquarian bookstores of Europe. I believe the library of the School of Mines of Columbia College contains a German copy. In the preparation of this paper I have made use of the Latin edition, which is the only one in my possession. An excellent summary of the subject, containing many curious details, will be found also in Prof. Moritz Gaetzchmann's "Auf- und Untersuchung der Lagerstätten" (Freiberg, 1857). The Brooklyn Library contains a copy of a work entitled. "Jacob's Rod. A Translation from the French of a Rare and Curious Work, A. D., 1693, on the Art of Finding Springs, Mines and Minerals by means of the Hazel Rod. To which is Appended Researches, with Proof of the Existence of a More Certain and Far Higher Faculty, with Clear and Ample Instructions for Using it." Published by the translator, Thomas Welton, 13 Grafton street, Fitzroy Square, London. This book was published, I believe, in 1875. The title-page bears no date. The original French treatise, the translation of which occupies the first part, is probably the one entitled "La Verge de Jacob, ou l'Art de Trouver les Trésors," which Figuier (Histoire, etc.; vol. ii, p. 257) speaks of as well known to the adepts in occult sciences, and Chevreul (La Baguette, etc., p. 30) mentions as an example of the use of the term "Jacob's Rod" in those sciences, to signify a rod possessing marvelous properties. The origin of this signification will be found in Genesis, xxx. I suspect that neither Figuier nor Chevreul had seen this book; both of them fail to give either the name of the author or the date of publication, an omission especially noticeable in the case of Chevreul, who is usually both full and careful in his references. The translator gives the date as 1693, and names the author as M. Baritel. Of the fidelity of the translation I have no guaranty except internal evidence, from which I judge that it is honest rather than intelligent. This translator, Mr. Walton, is himself a mesmerist, an electro-biologist, and declares his wife to be possessed of clairvoyant powers, of the exercise of which he believes the discovery of water, metals, etc., to be but one sub-division. The object of his translation and "addenda" is to connect the ancient phenomena of rhabdomancy, the observations and theories of Reichenbach, the fanciful speculations of Bulwer-Lytton, and numerous modern wonders (accounts of which he extracts from the *Spiritual Magazine*), and his own and his wife's alleged experience. To the works above named I am indebted for nearly all the facts cited in this paper, and from many quotations made at second-hand.

Professor Fiske, following Dr. Kuhn, whose treatise on the "Descent of Fire" was published in Berlin in 1859, traces the divining-rod to a widespread Aryan myth, connected with the forked lightning. Without going so far back, we may find in written history many evidences of the use of the rod, not only as a symbol of earthly power, but also as the instrument of supernatural effects, and particularly of divination. It will be remembered that the Egyptian sorcerers, confronted by Moses, carried rods, as Moses and Aaron also did. The prophet Hosea denounces the use of rods for divination by the Jews (Hosea 4:2). According to another prophet (Ezekiel 21:26) the King of Babylon consulted rods or arrows to decide his course. The Scythians, Persians and Medes used them. Herodotus says that the Scythians detected perjurers by means of rods. The word Rhabdomancy, originated by the Greeks, shows that they practiced this art, and the magic power of the rods of Minerva, Circe, and Hermes or Mercury, is familiar to classical students. The Lituus of the Romans, with which the augurs divined, was apparently an arched rod. Cicero, who had himself been an augur, says in his treatise on divination that he does not see how two augurs, meeting in the street, could look each other in the face without laughing. At the end of the first book of this treatise he quotes a couplet from the old Latin poet Ennius, representing a person from whom a diviner had demanded a fee as replying to this demand, "I will pay out of the treasures which you enable me to find." This ancient joke, by the way, has been adopted in all seriousness by the "oil-smellers" of Pennsylvania, who, as I am informed, are accustomed to locate oil wells on precisely this condition, receiving nothing if the well proves unsuccessful, and $50 if oil is struck.

Marco Polo reports the use of rods or arrows for divination throughout the Orient, and a later traveler describes it among the Turks. Tacitus says that the ancient Germans used for this purpose branches of fruit trees. One of their tribe—the Frisians—employed rods in church to detect murderers. Finally, if we may trust Gonsalez de Mendoza, the Chinese, who seem to have had everything before anybody else, used pieces of wood for divination. Thus we perceive that the application of the divining-rod in historical antiquity was mainly or wholly moral; that is, it was employed to detect guilt, decide future events, decide courses of action, &c. There are but two passages which have been quoted to prove its use for physical purposes—one from Ctesias (*apud. phot. bibl. cod.*), who speaks of a rod of the wood *Parebus*, which attracted gold, silver, other metals, stones and several other things; the other from Cicero ("De Officiis," lib. i.), who says: "If we could obtain with the so-called divine rod everything pertaining to food and clothing" (*ad victum cultumque*), &c.

On the other hand, the silence of many authors is significant, as Chevreul has pointed out. Varro does not mention the use of the rod for the discovery of subterranean waters or metals. Vitruvius, discussing the means of discovering springs, says nothing of it. Pliny, in Book XXX of his "Natural History," omits it from his enumeration of magical arts and methods, and in Book XXXI, describing (after Vitruvius) the means of discovering springs, and in Book XXXIII, describing explorations for metals, is equally silent concerning it. Columella, Palladius, and in the sixth century Cassiodorus, are likewise dumb, though the latter in one of his epistles ("Theodoric LIII") extols the utility of the professional water-discoverers. Even as late as 1569 a book printed in Orleans ("L'art et Science de Trouver les Eaux et Fontaines Cachées sous Terre Autrement que par les Moyens Vulgaires des Agriculteurs et Architectes," par Jacques Besson, Dauphinois, mathematicien), contains no allusion to the rod. It is a curious circumstance that this work emanated from Dauphiny, the home, a century later, of the most famous diviners and water discoverers.

But the alchemistic literature brings the physical uses of the dividing-rod to the front. The first mention is usually credited to the "Novum Testamentum" of Basil Valentine, a Benedictine monk and hermeneutic philosopher of the fifteenth century. But it must be remembered that the existence, even, of this man is not beyond doubt. It is attested by Gadenus "Historia Erfordiensis," (1675), who says that Basil was living at the convent of St. Peter's, at Erfurth, in 1413. Yet the "Testamentum" was actually first printed at the beginning of the seventeenth century, though manuscript copies had been circulated earlier. Of these, Chevruel possesses one (a French translation) dated 1651, and from its quotes the famous passage according to which, at the time of the writer, the divining-rod was worn in the belt or the hat, and was used to discover metals. Basil describes seven varieties of the rod, according to its different motions. Whatever its antiquity, the use of the rod to discover hidden treasure or metallic ore became general in Germany, and was extended thence through Flanders, England, Sweden, France, Italy and Spain before the end of the seventeenth century. It must be remembered that in those days the practice of burying money and plate was universal. A rod that would discover buried treasure only would, at the present

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time, be comparatively little value. We know well enough where the large masses of gold and silver are piled. It is not ignorance, but bolts and bars, that prevent our getting at them; and a large class of the diviners of the Middle Ages would be obliged, if they lived to-day and practiced their profession, to become burglars or cashiers.

The scientific explanation of the divining-rod at this period, like the scientific explanation of nearly all facts in chemistry and physics, was "affinity," a word under which was concealed a little science together with a vast amount of ignorance and superstition. Philip Melancthon (1497–1560), the friend of Luther, adopted this theory to explain the effects of the divining-rod. We must confess that in an age when the attraction of the magnet for iron and of electrified amber for light bodies was known, but not understood, there was no necessary absurdity in supposing that similar phenomena might be exhibited by other classes of substances. And this natural presumption, joined with the inherent credulity of ignorance and the tendency to generalize upon imperfect data, caused a very general acceptance of the alleged operations of the divining-rod as true, and consequently the promulgation of crude quasi-scientific theories to account for it. On the other hand, it must be remembered that the belief in demoniac agencies was still active and all-pervading, so that when facts could not be scientifically explained they were at once referred to witchcraft or to the devil direct. So long as the discussion remained within the field of science it was conducted with courage and candor; but when it entered the demoniac domain, the boldest philosopher, unless he were willing to sell his soul to Satan, became dumb. This may explain the attitude of the great Agricola ("De Re Metallica," lib. ii.), a keen observer and wise reasoner, who, after saying that the alleged virtues of the divining-rod are subject to much dispute, and stating both sides of the dispute with admirable clearness, demolishes in a few words the supposed analogies of magnetism and electricity, but declares that if the divining-rod derives any power from spells and incantations, that is a matter neither permissible nor agreeable for him to discuss. He proceeds, moreover, to assert as the general result of experience in his time that the professors of the divining-rod, though they sometimes succeed in discovering veins, quite as frequently fail, and have to dig like other people if they wish to find anything. Wherefore, he advises the respectable and sober miner to study the indications of nature, and then dig at once, without further fooling. In the quaint woodcut which accompanies this passage a miner is represented in the background as cutting his hazel twig, while another in the foreground is proceeding with it in due form for the discovery of the mine: and (whether in sarcasm or not, I do not undertake to say) at the very point to which the latter is steering, two of Agricola's "good and sober" miners have already found ore by the homely process of digging.

Paracelcus (1495–1541) condemns in his works, as uncertain, illusory and unlawful, the use of the rod. His disciples did not uniformly agree with this view. Goclenius, author of "Essays on the Virtue of Plants and the Unguent of Arms," believes in the efficacy of the rod and does not condemn its use. Libavius, author of the "Syntagma Arcanorum Chamicorum" (died 1616), believed in it from experience, and explains its action by sympathetic affinity. This theory, already announced by Melancthon, was also held by his son-in-law, Peucer, by Porta "Magia Naturalis" (1569, lib. xx., cap. viii.), by Keckerman (1573–1609), "Systemata Physica" (lib. i., cap. viii.), by the author of one of the discourses published with those of Miaolus, Bishop of Volturara (1614), and by Michael Mayer, the prolific author of alchemistic allegory, "Verum Inventum, hoc est Munera Germaniæ" (cap. iv.), who, describing the invention of gunpowder in Germany and the use of hazel-charcoal in its original manufacture, mentions the sympathy which hazelwood has for metals, and its consequent employment in the form of the divining-rod. On the other hand, the Jesuit father Laurentius Forer, "Viridarium Philosophicum seu Disputationes de Selectis in Philosophia Materiis" (1624), condemns the use of the rod as a superstitious practice. We must distinguish, therefore, three different views of the question; two of which accepted the efficacy of the rod as proved, and ascribed it respectfully to a physical property of the rod, and to demoniac agency, while the third discredited the alleged facts, and pronounced the practice to be a superstition.

A fourth view was indeed advanced, according to which the operator, as well as the rod, was the recipient of a divinely-given faculty. It was no doubt with the purpose of avoiding the odium attached to dealings with the Evil One that the professors of this science, particularly in Germany, surrounded it with ceremonies and formulas of a highly pious character. It is true that the rules sometimes prescribed for the cutting of the twig partook largely of heathen sorcery and astrology. They were indeed, to some extent, unconscious reminiscences of the old Scandinavian, and even of the Aryan, mythology. But this was atoned for when the rod was duly Christianized by baptism, being laid for this purpose in the bed with a newly baptized child, by whose Christian name it was afterward addressed. The following formula, cited by Gaetzschmann, may serve as an example: "In the name of the Father, and of the Son, and of the Holy Ghost, I adjure thee, Augusta Carolina, that thou tell me, so pure and true as Mary the Virgin was, who bore our Lord Jesus Christ, how many fathoms is it from here to the ore?" In this case, the rod was expected to reply by dipping a certain number of times, corresponding to the number of fathoms. Such devices, however, were not everywhere successful in diverting from the practitioners of this occult science the evil name of sorcery. A striking and pathetic instance is furnished in the seventeenth century by the history of the Baron and Baroness Beausoleil. The Baron, born in Brabant, devoted himself to mineralogy and mining, and became, undoubtedly, one of the foremost mine engineers, of his time. He visited and studied the mines of Germany, Hungary, Bohemia, Tyrol, Silesia, Moravia, Poland, Sweden, Italy, Spain, Scotland, England and France. The Emperors Rudolph and Mathias appointed him counsellor and commissioner-general of the mines of Hungary. The Archduke Leopold made him director of the mines of Tyrol and Trent. The dukes of Bavaria, Neuburg and Cleves gave him the same title. Finally, the Pope did the same for all the Papal States. He appears to have amassed from these various employments a considerable fortune.

In 1600 he was engaged by the comptroller-general of the mines of France to open mines in Languedoc and some other provinces, and in 1626 this commission was still further extended. During this period he met and married his wife, who devoted herself with enthusiasm to his profession, studying and traveling extensively with him in Germany, Italy, Sweden and perhaps Spain. They even made a voyage to the shores of the New World. In 1627 their house was robbed under the legal forms of search on the charge of sorcery preferred by a local official. Their loss was estimated at a hundred crowns. They easily obtained acquittal of the charge; but it is an instructive commentary on the justice of the time that they never were able to recover their property. They went to Hungary, but returned to France in 1632 under a new commission from Louis XII. In this year the baroness, who was an accomplished author, published an account of 150 mines already discovered in France, and some medicinal springs. They expended in further explorations, nearly the whole of their fortune, but were unable, in the face of their jealous rivals and enemies, to obtain from the Government the grants which had been promised them, and by means of which they expected to reimburse themselves. Finally, the baroness published a work, addressed to Richelieu and entitled "The Restitution of Pluto" (reprinted at Paris in 1779), in which, with eloquent indignation, she declared the deserts of her husband and herself and asserted their right to the rewards promised them, urging the cardinal minister at the same time, by every consideration of the glory and greatness of France, to encourage the development of its mineral resources. Unfortunately, in this work she furnished new material for the slanderous accusation of sorcery. In magnifying the art of discovering mines and springs, and the skill required for this purpose, she gives a description of the means employed, showing that these hidden treasures are to be detected:

1. By digging, which is the least important way.
2. By the herbs and plants which grow above springs of water.
3. By the taste of the waters which flow from them.
4. By the vapors which rise from them at sunrise.
5. By the use of 16 scientific instruments and of seven rods (the seven rods of Basil Valentin) connected with the seven planets, etc.

The first four means were undoubtedly real and really employed. Under the fifth head we have an illustration of what is so common in the alchemistic and other mediæval writers, namely, the covering of the facts of nature and the methods of investigation with assumed mystery, to hide them from the vulgar. So long as the baron and baroness were spending their own money for the good of the State, they were permitted to go on, and even received complimentary notices from time to time, which, indeed, could not be withheld from persons of such eminent reputation. But when they became troublesome in their demands for more substantial favors, and came into collision with the "rings" which infested the kingdom, the charges of sorcery renewed against them furnished a convenient pretext for putting them out of the way. Richelieu may even have supposed that he was behaving in this case with lenity, since, instead of having them burned to death, as he did with another sorcerer of the same period, he only put the baron in the Bastile (1642) and his wife in Vincennes, where they soon (about 1645) died in destitution and misery, victims not so much of the superstition as the corruption of the times. It will be noted that the treatise of the baroness did not claim for the divining-rod any moral virtue. What the Beausoleils appear to have done for this instrument was to bring forward its use in the discovery of springs as well as metals. The literature of the period seems to ignore, in the main, any powers of the rod in prophecy or moral discrimination.

The Jesuit father, Cæsius, "Mineralogia" (1636), inclines to deny the efficacy of the rod. Robert Fludd, "Philosophia Moysaica" (1638), after mentioning the sympathy existing between the crab or oyster and the moon, between the rue and the fig tree, between myrtle and the pomegranate, adduces as an instance of similar sympathy between plants and minerals the dipping of a hazel-rod over a vein of silver or gold. The celebrated chemist, Rudolph Glauber "Pars Seconda Operis Mineralis" (1652), affirms from experience, and attributes to a physical property, the efficacy of the rod in exploring for metals. The Jesuit father, Jean Francois, "Science des Eaux" (1653), seems to admit the power of the rod to discover springs, but condemns its use. The erudite Jesuit father, Kircher, "De Arte Magnetica" (1654), "De Mundo Subterraneo" (1678), having proved by experiment that rods of wood alleged to be sympathetic with certain metals, were, when balanced upon pivots, not at all affected by the proximity of these metals, concluded that the sympathy was chimerical. In his later work he declared roundly that if the movement of the rod did not proceed from a joke or cheat on the part of the operator, it was not natural, and ridiculed those who fancied it could be caused by a vapor disengaged from the metal.

Edo Neuhusius, "Sacrorum Fastidicus" (1658), believes in the working of the rod, and attributes it to sympathy, or to the stars, or some other cause. The Jesuit father, Gaspard Schott, "Physica Curiosa" (1662), pronounces the use of the rod superstitious, or rather diabolical. But he adds in a foot note that pious and honest men have assured him both with regard to the turning of the rod and with regard to the striking of the hours by a ring suspended within a glass (*vulsum annuli filo intra scyphum suspensi et horas indicantis*), that the experiment does not always succeed, and hence he will not assert that the demon is not always acting. The argument appears to be that, if the devil had it in hand, it would not fail. The pious and honest men aforesaid also protested that the phenomenon was natural and not due to fraud or fancy. "*Sed nondum persuaserunt*," pithily concludes Schott. The passage is noteworthy as containing a reference to the wonderful pendulum, which became, at a later day, the subject of scientific treatises and still survives as a puzzle and amusement for children for all growths. Sylvester Rattray, "Theatrum Sympatheticum" (1662), believes in the sympathy of vegetables with minerals. According to him, the hazel is suitable for the discovery of silver, wild pine for lead, olive and palm for gold and silver.

It was in 1666 that Robert Boyle put the question, as member of the Royal Society of London, whether the divining-rod is really moved by the proximity of metal—a pertinent inquiry which no one seems to have answered by authoritative and thorough experiment, unless we may accept as sufficient those of Kircher, above mentioned. The accumulation of contradictory testimony from witnesses of all degrees of competency went on. Matthias Willenius, a German author, published in 1671 or 1672 a book called "A True Account of the Rod of Mercury," in which, as the title indicates, he appealed to astrology for the partial explanation of his theme, asserting that the influence of the stars under which the operator is born contributes to the turning of the rod over metals, "by the effect of the harmony established between heaven and earth." Frommann, "Tractatus de Fascinatione" (1674), says that, after long hesitation, he has decided that the use of the rod is lawful. The Jesuit father, Dechales, "De Fontibus Naturalibus" (1674), inclines to the same opinion, and speaks of the hazel as having been in all times (*omni tempore*) used as an index to springs. This is a curious illustration of the rapidity with which a tradition may come to be considered immemorial. In fact, if we except the striking of the rock in the desert by Moses—which is certainly not a case in point—the first trace of the use of the rod for discovering springs is in the works of the Beausoleils, scarcely 50 years before Dechales wrote his treaty.

Le Royer, a lawyer of Rouen, published in 1674 his "Traité du Bâton Universal," and in 1677 his "Traité des Influences et des Vertus Occultes des Etres Terrestres." He declares that the rod by its sympathetic virtue can discover all hidden objects, metals, springs, etc. But he ascribes to it no moral power. The Abbé Hirhaln, "De Typho Generis Humani, sive Scientiarum Numanarum Inani ac Ventoso Humore," etc. (1676), while scoffing at many reviewed beliefs, admits without

question the efficacy of the divining-rod. St. Romain, "La Science Naturelle Degagée des Chimères de l'Ecole" (1679), was one of the first believers in the rod to reject the sympathies and antipathies, and to substitute the Cartesian corpuscular hypothesis—of which I shall have more to say hereafter. Finally, the celebrated botanist, Ray, "Historiedes Plantes" (1686), classed the divining-rod among superstitions.

(TO BE CONTINUED.)

BOROUGH SURVEYORS.*

The position of a borough surveyor is somewhat anomalous. His office is of recent creation; his masters are men who, as a rule, are incompetent to understand his duties; his salary is inadequate to his responsibilities, and his tenure of office may depend upon the whims of a few agitators. On the other hand, his knowledge must be almost unlimited, far exceeding that of the architect according to the Vitruvian standard. He may have to undertake, as an engineer, sewerage and sewage utilization works, water and gas works, canals, docks, harbor improvements, river navigation, the protection of coasts against encroachments of the sea, the prevention of floods by rivers, the construction and maintenance of roads, bridges, and tramways; as an architect he may have to design and superintend the erection of lunatic asylums, municipal offices, hospitals, abattoirs, mortuaries, baths, wash-houses, cemetery chapels, stables, police stations, and other similar works; if there are recreation grounds, public parks, or cemeteries, he is expected to be a landscape gardener; all kinds of surveying, quantities, estimates, valuation of property, measuring land, laying out streets, are considered to be mere trifles for him, and, like the examination of accounts, to be undertaken in spare moments. Difficult as those subjects may be, they are easy of attainment compared with the diplomacy which is requisite to enable the surveyor to go through council and committee meetings. Many a borough engineer would rather prefer to spend his day in laying out drains than in attending the council chamber. Contractors and navvies are often exasperating, but for taking the life out of a man they are not equal to the guardians of the public interests that are to be found on every local board. Yet, in spite of the difficulties and risks attending the office, every advertisement for a borough surveyor attracts an immensity of candidates—it is supposed that the number of them corresponds with the number of pounds sterling in the salary. It is possible that the peculiarities of the office have attractions for some minds and that young men of combative tendencies anticipate pleasure in the "scenes" in which the surveyor has to participate, and a good deal of the delight of battle may be found in overcoming the pretensions of obstreperous ratepayers.

Mr. Boulnois is one of the borough engineers who have successfully held their position, and he inspired so much respect for his courage, efficiency and impartiality that the good people of Exeter—many of whom may have at one time regarded him as an enemy—actually presented him with pieces of plate and other substantial memorials on his departure from among them. A man who has been so victorious is well fitted to give advice to aspirants. If Mr. Boulnois was successful, it was owing to the fact that he knew his business and practiced it fearlessly. He, therefore, gives in his book suggestions which relate to conduct as well as those which refer to technical matters. Thus, for example, punctuality in attending committees is enjoined, among other reasons, because "the gentlemen who form municipal bodies give their time gratuitously, and everything should be done to save it as much as possible," a sentence which indicates that Mr Boulnois has acquired "the art of putting things," and it is one which is indispensable to an officer who has to deal with opposing interests.

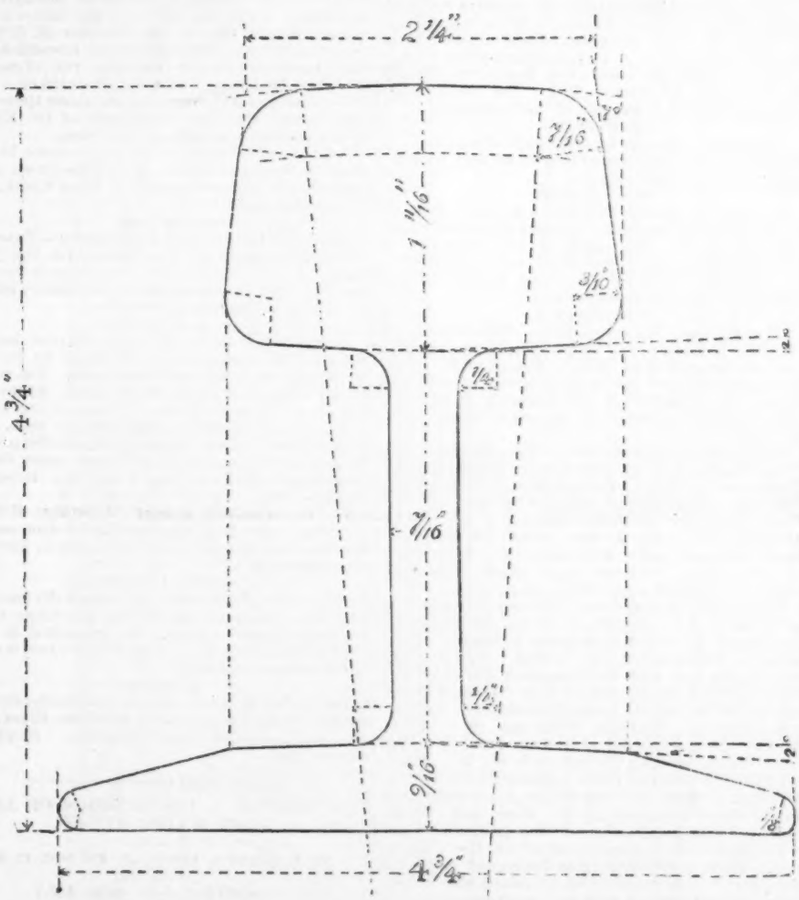
The construction and maintenance of streets form an important part of the surveyor's duties, and Mr. Boulnois devotes several chapters to materials, forming, rolling pitching, kerbing, channeling, etc. In them we find the results of his own experience, as well as the recorded results of other engineers in England and elsewhere, and the advantages and defects of various systems are stated fairly and clearly. Everything is considered, from machine stone-breakers and steam rollers to hammers and brooms. Specimens of specifications for the construction and repairs of roads are given. It is needless to say that the information will be useful to many who are not town surveyors, and such suggestions as those on concrete and tar pavements will be often applicable in covering the surfaces of yards and inclosures.

The model by-laws of the Local Government Board are made the subject of a chapter. The ambiguities of phrases in the clauses are discussed. Thus, for example, "new building" is sometimes defined by the aid of the Public Health Act, in which there is an equal difficulty as respects ground floor. When it said that "the re-erecting of any building pulled down to, or below the ground floor, or of any frame building of which only the framework is left down to the ground floor, etc., shall be considered the erection of a new building," Mr. Boulnois asks whether the words mean the actual floor level, or the cubical space contained by the walls, floor, and ceiling of the ground floor or ground story of the building? The uncertainty has given rise to some sharp practice, so as to make the local authority powerless when old buildings are transformed into new ones. The following is one of the dodges: "Sometimes a so-called repair of a building is commenced by adding a new roof, perhaps, at a higher level than the old one; when sufficient time has elapsed to allay suspicion a new front is erected, and then new back and side walls in due course, the alteration of the interior floors not attracting much attention." Mr. Boulnois doubts whether it is possible to prosecute when an old building is gradually converted into a new one, as the complaint has to be made according to the Public Health Act within six months from the time when the matter of the complaint arose. The complaint could not be been made when the work was first commenced, as no offence would have been committed, and if made after the work was finished, it might be urged that the offence was commenced more than six months prior. Mr. Boulnois says that it is possible in towns for a man to convert stables and warehouses into dwelling-houses, although they may not be adapted for that purpose. He has simply to get some one to prove that they were originally constructed for human habitation, and the Public Health Act, through the unwisdom of the 159th section, becomes an instrument for creating what may be a source of danger.

Mr. Boulnois has to admit the inefficiency of the inspection that is now practiced in towns. It is impossible for a surveyor, having a multitude of other duties engrossing his attention, and who in some places is without an assistant, to properly examine houses while in course of construction. The by-laws are so stringent that even an honest builder may be forced to evade them. In one respect they are modeled on the Metropolitan Building Act, and sacrifice much to prevent the spread of fire. Mr. Boulnois is of opinion that fires chiefly affect insurance companies. He would have every one pay an insurance premium, and let the companies look after their own interests. Life ought to be of as much interest as property, "yet no clause can be discovered in the model by-laws rendering it compulsory to make some provision in dwelling-houses or factories for the easy escape of the inmates in case of fire." Mr. Boulnois also is sceptical about the advantages of the large open space at the back and sides of a small house. He has found the space turned into a receptacle for garbage and filth, thus becoming a source of disease to the neighborhood.

There are many other chapters in Mr. Boulnois' book which we should have liked to notice if space were available. It is full of information, is arranged in the way that is best adapted for reference, and is entitled to become a borough surveyor's *vade mecum.—The Architect.*

* *The Municipal and Sanitary Engineer's Handbook.* By H. Percy Boulnois, C.E.



SECTION OF RAIL SOUTH PENNSYLVANIA RAILROAD, FULL SIZE. WEIGHT 71 LBS. PER YARD.

HOW TIME-TABLES ARE MADE.

ONE OF THE MOST DIFFICULT DUTIES IN THE RAILROAD BUSINESS.

One of the most laborious things connected with the management of a railroad is the instituting of changes in the time-table governing the running of trains. Instead of it being done with pen and paper, as many may suppose, the entire running arrangement of all passenger and freight trains, their crossing of other tracks, or passage of other trains, their stops and lost time, are all calculated by simple, common pins and spools of different colored threads. Before a time-table or schedule is prepared the time chart is first perfected. To prepare a time chart, a large sheet of drawing-paper is first stretched on a smooth surface and mounted on an easel. The chart is ruled either for two, five or ten-minute time by horizontal lines and perpendicular cross-lines. The "time" is marked above the horizontal line, and the distances, or stations and terminals, down the first perpendicular line.

For illustration, 12 midnight is the mark on the first horizontal line, and each hour is marked until the twenty-fourth, or the following midnight hour is reached on the last horizontal line. Between the hour lines the space is divided into minutes and graduated as fine as desired. On a two-minute chart the space between the hours is divided into ten minutes' time and the ten minutes' time into two minutes' time. The hour lines are made heavy, and the lesser time lines are of a

lighter shade to distinguish them. The one terminus of the road, Milwaukee, for instance, is marked on the first line beside the first time mark, 12 midnight. The other stations follow down the perpendicular line until the other terminal is reached. Then all is ready to prepare for the running arrangement, provided the pins and thread are ready. A blue thread means a passenger train a red thread a freight train, and if the trains of other roads use part of the track they are designated by a different colored thread. It is calculated that the running time shall be, say twenty-five miles an hour, and for the purpose of illustration, the tracing of one passenger train will answer the purpose of explaining them all. A passenger train leaves Milwaukee at 8 a. m. A pin is placed on the horizontal line at the 8 a. m. time mark and the end of the blue thread fastened thereto. If the train runs without stopping for 50 miles, the blue thread is stretched over opposite to the station at which the stop is made, and directly under the 10 a. m. time mark another pin is stuck, and the blue thread wrapped about it to keep it taut. If this is a stop, say of 40 minutes, the blue thread is stretched to the 10:40 a. m. mark on a direct line with the same station, and another pin stuck and the blue thread wrapped. The train starts, and its entire course is thus timed and distributed along the road. If the railroad has, say, 40 or 60 passenger and freight trains running daily, the time chart, when it is completed, looks like a great spider's web stretched out with pins. But little work then remains to transfer the time and stations to the time-table, and the schedule is ready for the printer.—*Milwaukee Sentinel.*

PYRAMID FACTS AND FANCIES.

TWO UNITS OF MEASUREMENT SAID TO BE USED IN ITS CONSTRUCTION.

The two papers of the evening at the meeting of the Ohio Auxiliary Society, held last evening, were from Prof. Joseph Baxendell, astronomer, the observatory Birkdale, Southport, England, and Chas. Casey, C.E., of Pollerton Castle, Carlow, Ireland.

Professor Baxendell divided his paper into three distinct parts: First was "Remarks on Mr. Dow's Reply to His Criticism of Mr. Dow's Paper;" second, "Length of the Pendulum's Vibrating Seconds and Time Length of Pyramid Inch;" third, "The Original Length of the British Inch and its Relation to the Pyramid Inch."

In discussing the second part of which paper, the Professor finds from various deductions that the Pyramid inch is 1-9892 longer than the British inch, which comes remarkably close to previous results. And in the last division of his paper he supports Messrs. Dow and Latimer in their theory that there were two different inches used by the architect of the Pyramid—one of which enables us to trace the relations of all the various parts of the Pyramid and has special reference to the length of the year and of the grand gallery, and the other that which is closely indicated in Mr. Dow's equations and is related to the divisions of the circumference and diameter of a circle and which has reference to certain parts only of the Pyramid. But this second inch, he thinks, is not the present British inch, since he finds that while the Pyramid inch is 1-989th greater than the present British inch it is only 1-1036th greater than the inch indicated by Mr. Dow's equation; but there can, he thinks, be little doubt that the length of the inch thus indicated is the original length of the present British inch.

Mr. Casey's paper in reply to an article by Professor Proctor on "Pyramid Prophecies and Egyptian Events" was a valuable production, and was listened to with much interest.

The astronomer royal for Scotland, Professor C. Piazzi Smyth, in a recent letter read by the secretary, expresses himself as much pleased with what Professor Stockwell has done in relation to the moon's period four thousand years ago, which was embodied in a paper read before the society at their meeting on the 25th ult., and hopes that he will communicate it to the Royal Astronomical Society at London, where they have just been finding an apparent error in their computations of the length of the solar day of the earth, but no one has ventured to carry it back further than five hundred years, and most of them are content to work within one tenth of that time, while Professor Stockwell has gone back four thousand years.

The President read an extract from an article on the International Exposition now being held in Boston, which spoke in very high terms of a model of the Great Pyramid which is there on exhibition, the credit of which is due the untiring efforts of Mr. Bisbee, the Secretary of the Institute, who has been working at it for some time. In addition to which letters were read from Mr. Plumptree and Joseph Baxendell, of England, and Rev. James A. Upjohn, Neenah, Wisconsin, the author of two valuable books on "The Name Counted" and "The Number Counted."

On account of want of time the reading of a lengthy letter from J. L. Dampier, of Canada, was deferred until a subsequent meeting.

The following persons were elected members: R. C. Oakley, Roselle, New Jersey; F. B. Dunn, David B. Prevost and Justus Morris, Elizabeth, New Jersey; B. Murtaugh, Jersey City, New Jersey; J. H. Worth, Westfield, Retford, England; Dr. C. F. Sibbald, Sutton, Canada; Sidney J. Sanford, Barrie, Canada, and Theodore Faber, Brooklyn, New York.

After discussing at some length the subjects presented it was decided to continue the discussion on weights and measures at the meeting on the 26th inst.—*Cleveland Plaindealer, Sept.* 13.

RAILROADS IN THE UNITED STATES IN 1830.

The following "Description of Railroads in the United States" we reprint from a scarce "Treatise on Railroads," by Thomas Earle, published in Philadelphia, in 1830. It is in striking contrast with a "Poor's Manual" of the present day:

MASSACHUSETTS.

Quincy Railroad.—From tide-water, near Boston, to stone quarries; distance, 3 miles; cost, about $11,000 per mile; finished about three years. Profitable.

A company is incorporated to make a railroad from Boston to the Connecticut River, near Brattleboro, Vermont, 160 miles, from whence it is proposed to extend it to Lake Champlain. Railroads are also proposed from Boston to Albany, N. Y., and to Providence, R. I. The routes have been surveyed by direction of the legislature.

NEW YORK.

Albany & Schenectady Railroad.—Length about 18 miles. It is understood this work will be commenced the present season.

NEW JERSEY.

Camden & Amboy Railroad.—Extent about 65 miles from the Delaware, opposite Philadelphia, to Amboy, N. J. The stock of this company is already above par. The work will probably be commenced this year. The route will be up the Delaware as far as Bordentown.

PENNSYLVANIA.

Pennsylvania Railway.—From Philadelphia, by way of Lancaster, to Columbia, Lancaster Co., on the Susquehanna River. Distance 84 miles. Cost about $15,000 per mile, if made of iron and stone. The *graduation* and bridging of 40 miles will probably be completed this year. Grade, 28 ft. per mile.

Allegheny Portage Railway.—Length, 28¼ miles from Frankstown to Johnstown, connecting the Pennsylvania canal. Estimated cost, with tunnel, $936,000. Not to be commenced *till* 1831.

Mauch Chunk Railway.—Length 9 miles from the coal mine to the Lehigh River. Of wood and iron. Sleepers, oak; rails, pitch-pine. Iron plates ⅜ by 1½ in. Cost of single track, $3,050 per mile. Completed about three years since.

Schuylkill West-Branch Railway.—Extent 13 miles from Schuylkill Haven to the coal mines on the Broad Mountain (including a branch of 2½ miles). Commenced Oct. 1, 1829. The rails are now laying and will be completed June 1, 1830. Grade, 27½ ft. to the mile. Cost, between $6,500 and $7,000 for double track, intended for locomotive engines. Sleepers, white oak 10 to 12 in. broad. Rails, white oak, 4 by 7 in. Iron, ½ by 1½ in. Width between the rails, 4 ft. 8½ in. There are 54 bridges on the road, reckoning each arch as a bridge. Where the foundation is not rocky and solid, three trenches 18 in. wide and 18 in. deep are dug lengthwise of the road and filled with large broken stone upon which the sleepers rest. These trenches serve as drains and keep the road dry. For rapidity of execution and excellence and economy of plan and workmanship, this road probably exceeds any that has been made. It is worthy of examination of every person interested in or curious concerning railways.

Engineer, Mr. Sam H. Kneass; Superintendent, Dr. Benj. Kugler.

Mill Creek Railway.—Extent about 3 miles from Port Carbon, Schuylkill Co., up Mill Creek to coal mines. Single track. Rails, wood, 3 by 5 in. covered with iron ⅜ by 1¼ in. Cost about $1,450 per mile, including iron. In operation in 1829. It is intended to extend this railway up the Broad Mountain.

Schuylkill Valley Railway.—Extent 10 miles from Port Carbon eastward up the Valley of the Schuylkill nearly to its head. Graduation 27 to 54 ft. to the mile. Rails of wood 3 by 5 in., to be covered with iron. Double track. Cost near $3,000 per mile, exclusive of iron. This railway was used last year for transportation up on the wooden rails. They are to be plated with iron the present year. The route passes through an abundant coal district. Superintendent, Mr.——Lawton.

There are lateral wooden railways connected with the above which cost $640 per mile for single track.

Mount Carbon Railway.—Extent, 9 miles of double way, from Pottsville up the Norwegian Creek to the forks, and thence up the two branches to numerous coal veins. Rails, wood, 6 by 8 in., with iron plates ⅜ by 2 in. Probable cost, about $6,000 per mile, including half a mile of expensive arched foundations at the landing. Engineer, Mr. Wm. R. Hopkins.

Lackawaxen Railway.—Extent, 16 miles from the termination of the Lackawaxen Canal, at Honesdale, Wayne County, to the coal mines at Carbondale, on the Lackawanna, passing through Rixes' Gap, in the Moosic Mt. An ascent and descent of 1,812 ft. is overcome by eight inclined planes, at five of which, on the western side of the mountain, there are stationary engines. Cost, about $12,000 per mile, including engines, etc. In operation in 1829. Object, conveyance of coal.

Swatara Railway.—Intended to extend from the head of the feeder to the Union Canal to coal mines on the head waters of the Swatara.

Lykens Valley Railway.—Incorporated in 1830. Intended to extend about 16 miles from the Susquehanna River, near Millersburg, in Dauphin County, to the coal mines in Dauphin and Schuylkill Counties, near Gratztown.

Beaver Meadow Railroad.—Incorporated 1830. To extend to the excellent coal quarries at the Beaver Meadow, Northampton County, to the Schuylkill, the Lehigh, or the Delaware, at the option of the company.

Little Schuylkill Railroad.—Extent about 18 miles from the mouth of the Little Schuylkill up the Valley of the Stream to the coal mines at Tuscarora, Mauch Chunk and Panther M. & S. A branch is to leave the river near Greenfield and pass northwestwardly through the Tuscarora Mountain by a tunnel of near one-third of a mile. This railway is to be commenced about the present time under the superintendence of Dr. Kugler. Will probably be completed next year.

Pine Creek Railroad.—To extend about 12 miles from the Sharp Mountain down Pine Creek to join the Schuylkill at the mouth of Pine Creek. Not yet commenced.

DELAWARE.

New Castle & Frenchtown Railway.—Extent, 16 miles, to connect the Delaware with the Chesapeake on the route between Philadelphia and Baltimore. The ground is now under survey and the work will be promptly prosecuted.

MARYLAND.

Baltimore & Ohio Railway.—Extent between 300 and 400 miles, from Baltimore to the Ohio River at a point not yet determined. The work is nearly completed for about 13 miles. In progress for about 53 miles further. Cost of the first 13 miles between $50,000 and $60,000 per mile. Estimated cost for the whole distance, $22,000 per mile. Rails of pitch pine supported upon cedar sleepers and plated with iron ½ by 2 in. for locomotive engines.

Baltimore & Susquehanna Railway.—Intended to extend from Baltimore to the Susquehanna, at the Pennsylvania line, with a branch to York, Pa., about 60 miles.

SOUTH CAROLINA.

Charleston & Hamburg Railway.—Extent about 150 miles from Charleston to Hamburg on the Savannah River. Rails, iron, supported on stone. Cost not ascertained. A part of the line is understood to be completed.

KENTUCKY.

Lexington & Ohio Railway.—Incorporated; to extend from Lexington to the Ohio River, probably at Louisville, or at Maysville. Stock subscribed 1830.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 449.)

DLXVI.—BALLSTON SPA, N. Y.

Ballston Spa, in Saratoga County, New York, is a place of resort on account of the mineral springs found there.

Water-works were built by the village in 1865, taking the supply from a small stream by gravity. Distribution is by 10¼ miles of wrought iron and cement pipe of from 12 to 2 in. diameter, with 61 fire hydrants, 40 gates and 400 taps.

The population in 1880 was 3,011, and the daily consumption in 1882 was 5,000 gallons. The expenses of maintenance in 1882 were $1,500, and the receipts $4,500.

The works are managed by the village trustees. Henry White is the superintendent.

DLXVII.—CHAMBERSBURG, PA.

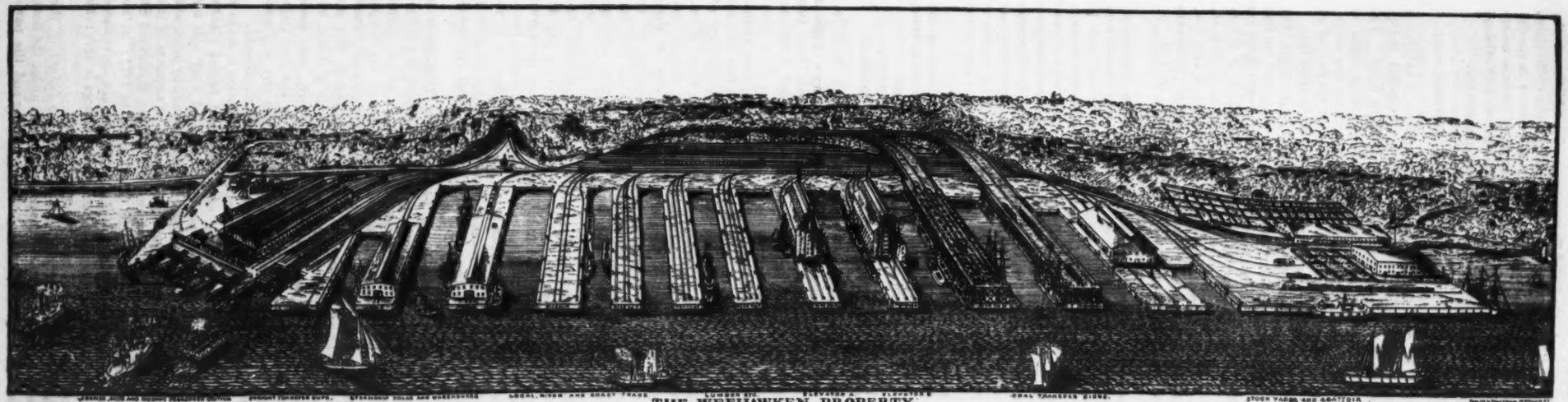
Chambersburg, Pennsylvania, is on rolling ground on Conococheague Creek. It is a very old town.

Water-works were built by the town in 1876, after plans of H. P. M. Birkinbine, taking the supply from a stream, the water of which is collected in an impounding reservoir and pumped by a Birkinbine steam pump into a distributing reservoir of 1,000,000 gallons capacity. In case of fire the water is pumped directly into the mains with 125 lbs. pressure.

Distribution is by 7 miles of cast iron pipe, with 45 fire hydrants, 30 gates and 500 taps. The population in 1880 was 6,877. The daily consumption in 1882 was 500,000 gallons.

The works cost $55,000. The expenses of maintenance in 1882 were $3,000 and the receipts $5,000.

A. C. McGrath is the superintendent.


THE WEEHAWKEN PROPERTY
OF THE
WEST SHORE & ONTARIO TERMINAL CO.
ON THE HUDSON RIVER OPPOSITE THE CITY OF NEW YORK
WALTER KATTE CHIEF ENGINEER

THE WEEHAWKEN TERMINAL OF THE N. Y. W. S. & B. AND N. Y. O. & W. RAILWAYS.

The terminal facilities of the above mentioned roads are so unusually extensive and complete in arrangement that they are deserving of more than passing notice, even in this day of huge business enterprises. The illustration in this week's ENGINEERING NEWS is made directly from plans in the company's office.

The total frontage on the Hudson River is 6,790 ft. or about one and one third miles, and 440 acres of land are occupied by the improvements at this point. This area permits of the ultimate laying of twenty-nine miles of track and sidings, affording storage room for about 8,000 cars. In addition to this mileage there will be fifteen miles of track in the New Durham yard, just west of the Weehawken Tunnel, which connects the two systems. In the Durham yard all freight cars arriving at, or leaving New York and the immediate vicinity, will be assorted in their proper trains. Floats, carrying from ten to fourteen cars each, will be used for conveying freight in bulk to New York, Brooklyn and Williamsburg.

The illustration gives a sufficiently clear idea of the general arrangement of the river frontage. The passenger depot, on the left, is now under construction and is being rapidly pushed to completion. From this front a ferry service will be run to Harrison St. and to 42d St., together with an annex boat to Brooklyn. The ferry-boats built for the Company by Ward, Stanton & Co. of Kingston, are to exceed in speed, and beauty of finish any boats of this class heretofore constructed; the hulls are iron and the engines and boilers are unusually powerful, so much so, that a speed of 20 miles per hour can be developed, and the crossing from Weehawken to 42d St. is to be made in four minutes. The hulls are peculiarly constructed so as to ride upon the ice-floes in the river and break them down by the weight of boat, instead of cutting through; this construction is intended to avoid the usual delays in transit from floating ice. Two of these boats are now in the slip at Weehawken, the third is about ready for delivering, and fourth is launched; the cost for each is $125,000.

There are twelve piers in all, the average dimensions of each being 1140 ft. long by 200 ft. wide, and the basins between the piers are 250 ft. wide with a depth of water of 30 ft. Immediately north of the passenger depot is the slip for the transfer of freight cars to the floats. Then follow in succession, the steamship wharves with their freight sheds and the piers devoted to the local river or coast traffic, and to lumber, &c. On Piers 8 and 9 the foundations are in place for two grain elevators of a capacity of 1½ million bushels each; these elevators will be filled out with the most approved machinery and are admirably located for the speedy and economic shipment of grain, ocean steamers being able to lay alongside both sides of the building. On piers 10 and 11 will be the bins for the transfer of coal to vessels. The northern portion of the property has been occupied for a long time by extensive cattle yards, abattoir, &c.

From this very brief description it will be seen that the company is well equipped for the handling of passengers and freight of all descriptions. Contrary to the usual method of proceedure, this company has provided in advance for the future demands of traffic, and time will doubtless prove the wisdom of so doing.

NEW BOOKS.

A new Steam-Engineers' Pocket-book has been issued by D. Van Nostrand, of New York. The full title is: "The Machinists' and Steam-Engineers' Practical Calculator. A Compilation of Useful Rules and Problems arithmetically solved, together with General Information applicable to Shop-Tools, Mill Gearing, Pulleys and Shafts, Steam Boilers and Engines, embracing Valuable Tables, and Instruction in Screw-Cutting, Valve and Link Motion, etc., etc.," by D. B. Dixon.

The title sufficiently expresses the purpose of the author, who presents this book as a "rudimentary manual" for the use of steam-engineers and machinists. His rules and calculations are based upon plain arithmetic, and are simply worded so as to be easily understood; algebraic formulæ and technical phrases have been carefully avoided in the compilation.

We can only add that an examination of the work bears out the author's claim; it is clearly printed, handy in form, and should find a corner in every machinist's tool-chest.

STATISTICAL.

PATERSON, N. J., Sept. 11, 1883.

EDITOR ENGINEERING NEWS:

I take objection to your statement in the issue of September 1st, where you say Troy can show "more neatly dressed, pretty working girls than all other American manufacturing towns together." While conceding a great deal for Troy, where I have lately been, Paterson can lead her by long odds in this particular, and you would acknowledge it if you were here some Sunday or holiday to see the large number of working girls dressed in silk and other expensive material.

Yours truly, JOHN T. HILTON.

[Mr. Hilton evidently wishes to force upon American engineers, through us, the discussion of a very important question—the comparative influence on female beauty of the manufactures of "high grade" American silk, or "first-class laundried" shirts and collars. Mr. Hilton's observations were made on "Sundays and holidays," when the "working girls" were out in "full feather and war paint;" ours were made at the close of a work day, and as regards the display of special manufactures we confess to being at a disadvantage in our facilities for judging how "expensive" they were. But before we surrender to Mr. Hilton, whose opinion, as City Engineer of the silk manufacturing city for many years, is entitled to careful consideration, we will yield to the temptation to which he has so recklessly subjected us, and institute our own comparisons from personal observation.—ED. ENG. NEWS.]

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NOTICES OF MEETINGS.

AMERICAN INSTITUTE OF MINING ENGINEERS—PROGRAMME OF THE TROY MEETING, OCTOBER, 1883.

LOCAL COMMITTEE OF ARRANGEMENTS:—R. W. HUNT, Chairman; HENRY BURDEN, Secretary.

Tuesday, Oct. 9.—Opening session, in Keenan Hall at 8 o'clock p. m. Reception to members and associates by the Troy Club, at 10 o'clock, p. m. Evening dress not expected.

Wednesday, Oct. 10.—Excursion by carriages at 9 a. m. to the Fuller & Warren Company's Clinton Stove Foundry; then to the Rensselaer Merchant and Rail Mills, of the Albany and Rensselaer Iron and Steel Company, and finally to the works of the Burden Iron Company. Mr. James A. Burden will kindly entertain the visiting members and ladies at his residence, Woodside, at 1:30 p. m.

In the afternoon a visit will be made to the Albany Iron Works and the Bessemer Works Department of the Albany and Rensselaer Iron and Steel Company.

In the evening there will be a session at 7:30, in Keenan Hall, for the reading and discussion of papers.

Thursday, Oct. 11.—At 9 a. m. a visit will be made to some of the shirt and collar shops and laundries of Troy.

Sessions for the reading and discussion of papers will be held in Keenan Hall at 10:30 a. m. and 3 p. m.

In the evening there will be a subscription dinner at the Troy House, at which ladies, as usual, are expected.

Friday, Oct. 12.—A special train will be provided to take the members to the Hudson River ore property, at Burden Station, as guests of the Hudson River Ore Company. After inspection of the mines and roasting kilns, lunch will be provided by the Company, and the party will then return to Hudson, where those going South can take the regular afternoon train, those going North remaining on the special train for Albany and Troy.

Hotel accommodations will be found at the Troy House ($3 per day); American House ($2.50 per day); and the Mansion House ($2 per day). The Troy House will be the headquarters of the Institute during the meeting, but it is not expected that all the members, and ladies accompanying them, can be accommodated there.

No reduced railroad rates have been obtained for the meeting.

It is desired that members should notify the Secretary of the Local Committee of their intention to be present at the meeting, and state whether ladies will accompany them.

Members are advised to secure rooms by writing directly to the hotels.

T. M. DROWN, Secretary, Easton, Pa.
R. W. HUNT, President, Troy, N. Y.

A conversation held between Capt. John H. Ackers of Brooklyn and a reporter with regard to the dredges used on the Panama Canal has given rise to some discussion. The Captain said the dredges were old and useless. He also stated that there was a stampede among the engineers. Mr. H. A. Linch, who is one of the managers of the dredging operations and who is now at San Francisco, contradicts Capt. Ackers' statement *in toto* and *seriatim*. He says:

"The great dredger, the *Countess De Lesseps*, the machinery of which was made here and set in position in Philadelphia, is doing splendid work, and in a cablegram which I received only yesterday, the report was that she was clearing away 1,000 cubic yards an hour. The second of the great dredgers, the *Prosper Huerne*, is completed and will be at work in about six weeks, and the third will be sent down as soon as the Philadelphia yard can get her in order. Ackers says that some of the excavators are those used at Suez and that they will be worthless on the isthmus. The fact is to the contrary, for while we have two or three of the small Suez engines, I can assure you they are doing admirable work. Ackers intimates that no white laborers will work on the canal. When I was last on the isthmus the white applicants for work numbered in the hundreds a week. The new locomotives, Ackers says, have been found too long for the short curves, with the intimation that they must consequently be rejected. He apparently forgets, in this display of ignorance, that the alteration of a curve is not an engineering impossibility. It is true there are two short curves, one at Bohio and one at Manne, but it was decided some time since to broaden these, and it is the further intention to completely alter the route of the railroad as the canal is built. The home stampede of the engineers and assistants, when boiled down to the simple truth, resolves itself into the very obvious fact that the climate of the isthmus is particularly trying to Europeans and that instead of running for home when they were sick the engineers are sent there to recuperate and at the company's expense."

ASSOCIATION OF ENGINEERING SOCIETIES.

No. 7, Vol. 2, of the journal of this Association has made its appearance. We note the following as the contents of the current number: "The Determination of Carbon in Iron and Steel—a New Method," by N. B. Wood, of the Civil Engineers' Club of Cleveland; "Project for Relieving the Mississippi River in periods of Extreme High Water," by Col. Chas. Whittlesey, Hon. Mem. Engineers' Club of Cleveland; and "Experiments with a Steam Engine." This last is a translation from the *Bulletin de la Société Industriel de Mulhouse* of 1877, and records the experiments made by Hirn, Dwelshauvers, Grosseteste and Hallauer.

THE INSTITUTION OF CIVIL ENGINEERS.

We have received the following excerpt minutes of the Proceedings of the Institution: "Apparatus for Solar Distillation," by Josiah Harding; "Tests of German Coals," by Dr. H. Bunte, of Munich; "The Coal and Mineral Deposits of Indo-China," by Edmund Fuchs and E. Saladin; "Air-Compressor and Turbine for Working Rock Drills and Ventilating Yanagase Tunnel, Japan," by Benj. Frederick Wright; "Resistance and Railway Curves as an Element of Danger," by John Mackensie; "A Method of Correcting Errors in the Observation of the Angles of Plane Triangles, and Calculating the Linear and Surface Dimensions of a Trigonometrical Survey," by Robert Manning.

STEAM HEATING.

D. Van Nostrand has reprinted as No. 68 of the Science Series, a paper on "Steam Heating, an exposition of the American practice of warming buildings by steam." This paper was written by the late Robert Briggs, M. Inst. C. E., and originally appeared in the Proceedings of the Institution.

It commences with a short history of the first application of steam to the heating of buildings; gives in detail the best practice in steam fitting; describes the boilers to be used under different requirements and treats of the method of obtaining circulation.

The covering of steam mains, steam stop-valves, radiators for diffusing heat and the system of ventilation as combined with warming, are also fully detailed.

In an appendix to the author's paper is given much useful data, relating to the subject under consideration. [Price 50 cents.]

THE EAST RIVER BRIDGE CARS.

The cable road across the East River Bridge was opened to the public on Monday, Sept. 24. Four months have passed since the bridge was formally dedicated, and this interval has been occupied in perfecting the details of this cable-roadway. The public has had its usual growl at the delay, but the present smooth and satisfactory working of the somewhat intricate mechanism will, in a measure at least, compensate for the loss of time.

In this initiative trip the cars ran on five-minutes time, and each car carried, in some cases, as many as 70 passengers, though the seating capacity is 46. The time consumed in crossing from station to station was six minutes. As soon as the Brooklyn terminus is completed three cars instead of one will be run on each trip, and the time reduced to probably three-minute intervals. There are 20 cars now ready for use; ten of these are on the tracks on the bridge, the remainder are still in the yard, on the Brooklyn side of the river.

Latest. The cable road is closed against public traffic.

THE PHILADELPHIA WATER DEPARTMENT.

We notice that Chief Engineer Ludlow is again calling the attention of the city authorities of Philadelphia to the great length of small pipe still remaining in the distribution system. Many of these pipes, laid at a time when the supply was almost nothing compared to the present demand upon them, are now clogged by rust to such a degree that what water passes through them simply does so by percolation through this accumulation of years.

It will cost $1,800,000 to replace these virtually useless 2-inch water mains by six-inch pipe; but while the tax may seem a heavy one to the tax payer, a conflagration may do more damage in a single night. The citizens have been sufficiently warned, for Col. Ludlow is simply repeating the recommendations yearly made by his predecessor. The warning has been unheeded in the past, but it is to be hoped that our neighbors will not have cause to bitterly repent over their economy.

As the Chief Engineer remarks, additions to the pumping plant are of no avail, as long as the mains are wanting to distribute this water in the districts afflicted; and these districts include nearly all of the old city, where the business and substantial wealth of the community are crowded.

THE STORM KING BRIDGE.

The N. Y. *Daily Graphic* for Sept. 25 contains a full-page illustration of the "Proposed Bridge across the Hudson River at Storm King." The design proves how easy it is to bridge space *on paper*, for there are only three spans in the bridge, two of 1,000 feet each and one of 800 feet, of an ordinary double-cancellation straight truss type.

The sketch is the work of the artist rather than the engineer; and from the license used we fear that the details of these unprecedented spans are yet to be evolved, otherwise some kind of the intended design would certainly have been conveyed. The truss will be either proportionately very low, or the cars to be used on this imaginary bridge are to be unusually high, if we can use the train depicted as a measure of dimensions.

The map of the railroad which is to pass over this bridge, which map occupies a conspicuous center in the picture, is probably "the meat in the nut," and furnishes an excuse for the presence of the "bridge;" especially as the text accompanying the illustration is silent as to the engineering problem presented, but very loud in expression of the many prospective advantages of this road which is "to shorten the distance from Boston to the west one hundred miles," as set forth in the sub-title.

In short, the illustration is not a view of any proposed bridge, but simply an attempt to boom the stock of a new "Shore-line" road.

WOOD PAVEMENTS IN PARIS.

Some of our Western cities are still discussing the merits of wood pavement. In New York it has long been completely tabooed, but this does not necessarily imply that wood pavement ever had a good "show" here. Most of the pavement laid down was under the *régime* and blighting auspices of the Tweed ring. In fact no good system applying to the peculiar conditions of New York traffic seems to have been found as yet. But wooden pavements have been popular and satisfactory in London, and the city of Paris is now about to pave a great number of its streets with wood. Paris began to use this material for the purpose as far back as 1840, although it had been tried in 1834 at St. Petersburg. But the difficulty of repairing wooden pavements, and the great damage that is done by allowing any depressions for humidity to accumulate in, form great drawbacks to its use. The whole pavement has to be replaced when there are many places to be repaired, and other systems were always adopted in Paris. There are now three of these systems of wood pavement used in that city.

The Trenaunay System.—The foundation is formed of a layer of béton $\frac{1}{10}$ of a metre (3.9 inches) thick. The blocks have the form of an oblique parallelopiped, so that in the same row the oblique faces rest upon one another. The joints are dressed with bitumen or cement. This system was put down in the square of the Ecole de Médecin, but had to be taken up after three years. Still some of the pavement is to be seen in the Rue Cujas—it was put down in 1872. The city engineers consider the system as completely abandoned.

The Norris System.—The foundation is made of a double flooring of crossed and tarred planks. The blocks are pine, impregnated with coal tar. The joints are closed in the lower end by bolts, and on top by a bituminous cement. Pavement of this system was down in 1871 on the Boulevard St. Michel; it had to be taken up in 1877; in the Rue du Château d'Eau in 1873; it had to be replaced in 1875; and in the Rue Saint George in 1876; this latter will be taken up next year.

The city engineers attribute the failure of this pavement to infiltrations of water under the flooring which rotted both the flooring and the pave-

ment. The flooring is said to have been too elastic, but perhaps the closing of the joints was defective.

The London Improved Wood Pavement Co.—This system is to be seen in the Champs Elysées. The foundation is a layer 0.15 metre thick of Portland cement. The blocks are creosoted red pine wood and are in the shape of rectangular parallelopipeds. The joints are filled at the base with melted asphalt, and on top with Portland cement and gravel sand. A good coating of gravel is put on the surface, and this gets incrusted in the top of the blocks. The system was tried in 1881, in the Rue Montmartre and the Boulevard Poissonnière. The city pays for 18 years to a sinking fund for first cost and an annual allowance of 4 fr. 85 c. per square metre for repair. Sufficient time has not yet elapsed to form a definite judgment. There are besides these the Henson system, in which the Portland cement is covered with strips of tarred felt, and also the joints stopped with felt. The Copland system is similar to the London, except that a bed of asphalt is placed between the blocks and the foundation layer.

THE KALAMAZOO (MICH.) WATER-WORKS.

W. R. Coats, C. E. Engineer to the board of water trustees, has been examining the water supply of the city in question with a view to its improvements, and from his interesting report we make the following extracts:

The present water supply is derived from a well of 314 sq. ft. superficial area, penetrating a water-bearing formation; pumped down so as to leave a nine feet head of water, the yield from this well is 4,000,000 gallons per day, leaving a depth of 15 ft. in the well. The water furnished is of excellent quality, and any further amount can be obtained by sinking another or by a larger well.

The faults in the existing city system of water-supply are, lack of pumping power, and inadequate distribution. The present pumping machinery has a nominal capacity of 2,000,000 gallons per day while the daily average consumption during August last was in excess of 1,200,000 gallons, and at times no doubt the demand fully met the maximum supply at the ordinary pressure of 45 pounds.

In case of a fire the pressure must be at once raised to 90 pounds. Under this increased pressure the ordinary service will require 3,000,000 gallons, with a further 2,000,000 demand for the fire. It is self-evident that 2,000,000 gallon machinery can not furnish 5,000,000 gallon duty. Besides this, any increase in pumping capacity must be at once followed or accompanied by a corresponding increase in the size of the distribution mains, which are now taxed to their utmost. It is possible to maintain now a pressure of 100 pounds at the pumping station, but this will be reduced to 40 pounds in the heart of the city by the friction in the present small mains.

Mr. Coats suggests as a remedy for these evils, either the duplication of existing mains, or replacing them by larger sizes, and the increase of the pumping capacity to 8,000,000 gallons; or, what he regards as far preferable, and less expensive, the abandonment of the direct-pumping system, and the substitution of a reservoir plant.

An existing elevation, 140 ft. above the pumps, supplies the locality, and upon this he recommends the construction of a reservoir of one or one and one half million gallons capacity. The reservoir to be built of Bessemer steel plates, $\frac{3}{8}$ in. thick for the bottom, and $\frac{1}{4}$ in. at top, and $\frac{5}{16}$ in. thick at bottom of sides; the reservoir to be cylindrical in form and 33 ft. in depth, and 75 ft. in diameter for 1,000,000 gallons, and 100 ft. in diameter for 1,500,000 gallons capacity. This tank to rest upon masonry and be surrounded by a brick wall, 2 ft. from shell, and covered over.

This reservoir being much nearer the distribution than the present pumping station, the increase in size of mains will not be so great as in the first plan of improvements proposed, and most favorable connections can be made with the existing system of distribution.

With the works reorganized as here proposed, a duty of 80,000,000 foot pounds can be obtained from the present pumps which now furnish only 30,000,000 duty. By adding a three million compound duplex pumping engine to the present plant and only pumping in the day time, allowing the reservoir to furnish the night supply, it is believed that a sufficient saving can be made in running expenses to pay the interest upon the investment, at least.

The cost of the proposed new mains and a one million gallon steel reservoir are estimated by the engineer at $40,000.

The question of an increased efficiency in water supply is now being fully agitated in the City Councils, and the reports submitted are in the hands of a special committee.

THE MEETING OF THE NEW ENGLAND WATER-WORKS ASSOCIATION.

This association met at Pawtucket, R. I., on Sept. 19, at the rooms of the Business Men's Association, where the visiting members were received by the Water Commissioners and the superintendent of the city water-works. The following is as complete a list of those attending as it was possible to obtain:

J. G. Tenney, Superintendent and Treasurer, Leominster, Mass.; C. W. Seymour, Superintendent, Hingham, Mass.; H. N. Hyde, Jr., Superintendent, Newtonville, Mass.; J. Henry Brown, Superintendent, Mystic Department, Boston Water-Works; James W. Lyon, Superintendent, Lynn, Mass.; George Taylor and Mr. Russell, of Everett, Mass. (Boston Water-Works), Addison Lane, Superintendent Melrose Water-Works; J. C. Hancock, Superintendent, George A. Ellis, Springfield; Alderman Read, Chairman of the Water Board, S. L. Brown, of the Water Board, Frank E. Hall, President of the New England Water-Works Association, Mr. Coombs, Chief Engineer of the Fire Department, Messrs. Fitts and Welch of the Union-Water Meter Company, all of Worcester; Thomas C. Lovell, Superintendent, Fitchburg; R. C. P. Coggeshall, Superintendent and Secretary of the New England Water Works Association, Chief Engineer of the Fire Department Macy and Mayor Wilson, all of New Bedford; N. Dennett, Superintendent, Somerville, Mass.; Robert M. Gow, Superintendent, Medford, Mass.; H. G. Holden, Superintendent, and others, Lowell, Mass.; B. S. Brinsdale, Secretary, Water Board, Birmingham, Conn.; W. C. Wilcox, Waltham, Mass.; D. W. Horace and Mr. Costello, Clinton, Mass.; H. W. Rogers, Superintendent and others, of Lawrence, Mass.; Phineas Sprague, Superintendent, Malden, Mass.; Thomas A. Hodge, Superintendent, North Adams, Mass.; Mr. Grannis, Superintendent, New Haven, Conn.; Chief Engineer of the Fire Department Coleman, of Taunton; A. H. Martine, Superintendent, and William M. Howes, Commissioner, Fall River, Mass.; Charles K. Walker, Superintendent, Manchester, N. H.; Mr. Joy, Superintendent, Milford, Mass.

The officials and semi-officials of the Pawtucket Water Works, as follows: L. B. Darling and R. D. Mason, Water Commissioners; Edwin Darling, Superintendent; James A. Andrew, E. L. Freeman, Fred. N. Goff, C. Fred. Crawford and E. A. Greene; Board of Firewards, Central Falls Fire District, A. O. Miles, Superintendent; H. F. Anthony and H. S. Babcock, Commissioners, and D. S. Ray, of the East Providence District; J. F. Clark and Alvin F. Miller, Valley Falls Hydrant Committee.

There were also present members of the Town Council and of past Town Councils, Capt. Collyer, Chief Engineer, and Capt. Horton, Assistant Engineer, of the Fire Department, and other town officials, and a large number of the members of the Business Men's Association.

The entertainment of the visitors was commenced by a tour of inspection of the Pawtucket water-works, the reservoir and both the new and the old pumping stations being thoroughly examined.

A description of the new pumping station and its machinery, which has not yet been fully given, will not be out of place in this connection:

The building is of brick, plain, but of good proportions and substantial.

On entering the door, on the right, the water-wheels are operated. These wheels, made by the National Water-Wheel Company, of Bristol, Conn., one of 58 horse-power, the other of 70 horse-power, are so arranged that either one or both can be run when a sufficient amount of water is passing over the dam, and it is expected that during six months at least in the year either one or both can be run, pumping 500,000 to 1,750,000 gallons daily, according to the power supplied by the water. The wheels and pumps are connected by cut gears, that are thrown in and out at pleasure, by means of a handscrew, rendering it practical to utilize just what water would otherwise run to waste.

On the left as one enters the building is the filter gallery, covering 460 square feet of surface. The water enters at the bottom passing under the filter-bed, which consists of two feet of stones, the largest and bottom layer of which are about the size of an egg, and as it was filled in layers of about six inches each, each layer of a smaller size until the top presents a layer of pea gravel. The water, after passing through this filtering material, passes through a gate into the pump well to supply the pumps, and it is also so arranged that it passes to another well, and will supply the lower station, thereby filtering all the water pumped for the works. This is said to be one of the best arrangements for filtering large quantities of water that has ever been devised.

A gallery of the same kind has been in use at Lewiston, Maine, for the past three years, and has proved its practicability in beneficial results.

On entering the engine-room is seen four of Corliss' horizontal, double-acting, crank pumps, connected in pairs with a cut gear in the centre, attached to the crank shaft. This is driven from a spur gear attached to the main line shaft extending from the water-wheels to the engine, which is located at the southerly end of the room. The pumps have a plunger of nine inches diameter and a twenty-inch stroke. Each pair is capable of pumping 1,500,000 gallons daily with ease. The first pair from the entrance are connected to adjustable cranks, which is said to be something never before attempted, and is original with the builder. They are so designed to be used with the water-wheels that any water running to waste over the dam may be utilized to operate the pumps, and by shortening or lengthening the stroke may be adapted to a range of power from 25 to 125 horse-power, pumping from 250,000 to 1,750,000 gallons daily. One can but admire the smooth action of these pumps, not the slightest vibration or jar being perceptible under a working pressure of 310 feet. As one passes along to the other pumps he finds they are exact duplicates of the first, except the cranks, which are stationary. For facilities in repairing or adjusting they stand unequaled.

Advancing beyond this pair of pumps the engine is seen. This is a Corliss horizontal steam jacketed condensing engine with the latest improved valve gear, which is very quick acting and effects a saving in fuel over the old style. The diameter of the cylinder is 20 in.; length of stroke, 48 in. The driving pulley is 16 ft. in diameter, with 32-in. face, and carries a double belt of the best oak tanned leather made by Weatherhead & Thompson, 30 in. wide, to a driven pulley 8 ft. in diameter connected with the main line of shafting. This shaft can be disconnected at intervals so that the engine can run two or four pumps or be disconnected entirely and the pumps be operated by the water-wheels alone, thus enabling either to be worked independent of the other or all in unison. Attention is next called to the boiler room annexed to the engine room. Here are two Corliss upright tubular boilers of one hundred horse-power each. Diameter of shell, 64 in.; height, 14 ft.; diameter of fire-box, 6 ft. 4 in.; number of tubes in each boiler, 84; diameter of tubes, 3 in. These boilers are so arranged that any person may enter them for inspection or repairs. Pipes and connections are so arranged for blowing out that it may be done while the boilers are in operation, thereby enabling the engineer to avoid the collection of sediment on the tube sheets. On consulting the steam-gauge it appears the boilers are under a pressure of ninety-five pounds, but a person not seeing the fires through the open furnace would not realize that there was any fire in the place; so well protected are they by non-conducting covering that very little heat is given off by radiation.

In front of the fire-box there is a Fairbanks platform scale, on which the fireman weighs all the fuel used in the furnaces, making a record, which is completed by the engineer in charge, on the books furnished for that purpose, together with all other items connected with the pumping of the water. This record is always open for inspection by any one desirous of so doing.

Upon the return of the party to the place of meeting, about 12:30, the association was called to order by Edwin Darling, Esq., who introduced Franklin A. Steere, President of the Town Council, this latter gentleman then welcomed the visitors to Pawtucket, in the following words:

Gentlemen of the New England Water Works Association and Visitors:—It is a pleasure to extend to you, in behalf of our citizens, a hearty welcome to Pawtucket, Your coming has been pleasantly anticipated by us. You have seen a portion of our town, and we have shown you a part of our water works. We have, we believe, a very good system of water supply. The quality of the water is good, and the pressure and supply is ample. Of these things, however, you will best judge for yourselves. Your association, the objects of which are set forth in

your constitution, commends itself to avorable consideration. Of it we have most flattering reports. I will not occupy your time, but I do desire to extend to you, in behalf of our people, a most cordial greeting, with the hope that this day's meeting will find an abiding place in your memory as one of interest and pleasure to you, as it certainly is to us.

Mr. Frank E. Hall, President of the Water Works Association, respended briefly, extending the thanks of the Association and its members for the words of welcome, for the attention paid to them, and for the generous hospitality .The members of the Association, said he, have had many pleasant anticipations of this meeting, since first the invitation was given, and I can say these anticipations are more than realized, and the day will be considered by the members of the Association as one of the pleasantest in their memories.

A substantial collation was then served, after which the visitors and their hosts gathered at Wilkinson Park to witness an exhibition of the Fire Department under Chief Engineer Collyer. This display consisted of the parade of the four hose companies, headed by a drum corps, and the playing of the six streams at one time over the top of the flag-staff, 112 ft. high, which stands in the center of the square.

After this exhibition was over, the party boarded the steamer *Pioneer* and enjoyed a trip down the river. As the steamer passed through the draw of the India Point bridge, the visitors were given another display of the Pawtucket Water Works; a squad of East Providence firemen were stationed on the wharf, and as the steamer sailed by ten hose-streams were thrown over her. The party finally landed at Silver Spring, and at once proceeded to the *vue de l'Eau* club house, where dinner was served, "with the compliments of the Water Commissioners, Superintendent and business men of Pawtucket, to the new New England Water Works Association." Mr. Superintendent Darling presided; Mr. Hull, President of the Association, replied to the welcome of Mr. Darling, returning thanks in behalf of the Association.

After dinner, a business meeting of the Association was held, Mr. President Hall presiding. Messrs. A. O. Miles, of East Providence; Nathaniel Dennett, of Somerville, Mass; Daniel S. Brinsmade, of Birmingham, Conn.; Horace H. Knapp, of Lowell, Mass.; James W. Morse, of Natick, Mass.; and J. Henry Brown, of Charlestown District, Boston Water Works, were elected to membership in the Association. Edwin Darling, Esq., presented cordial invitations to the Association to visit the establishments of the Pawtucket Gas Works, the Pawtucket Hair Cloth Company, the Slater Cotton Company, W. F. & F. C. Sayles, the Conant Thread Company, the Fales and Jenks Machine Company, and others. These invitations were received and the Association voted that they be placed on file, and to extend thanks to the proprietors and managers of these establishments for their kind invitations, which want of time only prevented the acceptance of.

On the return trip of the steamer many of the visitors landed at Providence, taking the Boston and Worcester trains home.

Superintendent Darling of Pawtucket is especially to be congratulated upon the success of the day. He was in general charge of all the arrangements, and to his energy, care and fore-thought the visitors and all concerned were endebted for their evident enjoyment, which was unmared by a single delay or hitch in the programme.

NEW YORK & BOSTON INLAND RAILROAD.

ALBANY, N. Y., Sept. 25, 1883.

EDITOR ENGINEERING NEWS:

In the last number of the NEWS we have read your account of the contemplated road between New York City and Boston, to be called the New York & Boston Inland Railway, and that the Messrs. Linn & McCarty will probably have the contract for building the entire road.

Can you give us the address of these parties? If you will do so we shall be greatly obliged.

Respectfully, ——.

The above is one of several inquiries which we have received during the week. We sent out a reporter to collect information, but failed signally. Nobody in New York knew Linn & McCarty. The following is from the Springfield *Republican:*

"It now appears that Linn & McCarty, the Russian capitalists, represent the money which H. A. Blood, formerly manager of the Boston, Clinton & Fitchburg road, has raised abroad for his long-cherished New York and Boston Inland railway. These gentlemen are in Connecticut and are said to have telegraphed a denial of the Boston *Herald's* impeachment of their ability to command $30,000,000. Mr. Smith of the New York firm of Smith & Ripley, who were said to have contracted to build the new road, tells an *Evening Post* reporter that they are ready to do this whenever Linn & McCarty have a right of way and the capital necessary to do the work on a cash basis. Mr. Smith further said that he knew nothing at present about the financial backing of the company in question, or in regard to its organization, and he could not refer the reporter to any railroad man or financier in the lower part of New York who was likely to be better informed. He said Mr. Ripley had paid more attention to the matter and might give further light, but the junior partner was out."

Inquiry at Smith & Ripley's office elicited nothing. C. J. Osborn & Co., of 34 Broad St. were named as being "behind the scenes." Mr. Osborn "had never heard of Linn & McCarty." Dwight and Drake, of 71 Broadway, formerly with Smith & Ripley, are now going over the line; we were informed at their office that it was scarcely probable that they would have anything to do with the matter.

But if it is desirable to know who Linn & McCarty are, send for the Boston *Herald* of the 22d. In an extended article that enterprising journal gives a racy and interesting sketch of the careers of the two great Russian capitalists who are to build the great air-line between this city and the Hub of the Universe. It is very interesting reading, and if not true would apparently give the "capitalists" good cause for an action against the paper in qustion. It is not a little singular that the daily papers in this city have had hardly anything to say about the road or its promoters. At present the scheme seems to be rather doubtful.

On Thursday a wild looking man, coatless, and with his shirt-sleeves rolled up to his elbows, came into our office and asked to see a copy of ENGINEERING NEWS. Having critically examined a number several months old, he asked for terms for the full front page and an editorial notice a column long. He then said he had taken the contract to build the "great air line railroad to Boston;" his wife and he were "great speculators;" she was in Boston and he was going to build from this end. He had built the Brooklyn Bridge; had bought the steamship great Eastern; had set all of Blake's pumps; and had bought all the cotton captured by the Confederate crusier Alabama; his father had raised a family of twelve just such wonderful speculators and engineers as he, and now he thought that a "trifle like the New York & Boston Inland R. R. wasn't much of a contract for such a man." We agreed with him that it was not, and finally induced him to go away and prepare his advertisement and editorial notice.

This is all we know about the new scheme and its "contractors."

[From the Railroad Gazette.]

It is reported that the New York & Boston Inland Company has concluded a contract with Linn & McCarty, of New York, for the construction of the road. The contractors, who are said to have held extensive contracts in Russia, are now inspecting the line of the road.

It is said from Boston that the contracting firm is not known there, and that its members are not generally supposed to have much financial strength. The firm is not known in New York.

PERSONAL.

LIEUT. FRANK A. WILNER has been detached from the Coast Survey and ordered to the Alert.

CIVIL ENGINEER T. C. MCCOLLAM has been ordered to temporary duty in the Bureau of Yards and Docks.

MR. CHARLES SPROAT has been appointed city engineer of Toronto, Canada, at a salary of $2,800 per annum.

LIEUT. ED. M. HUGHES has been detached from the Coast Survey steamer Gedney and placed on waiting orders.

S. S. MONTAGUE, Chief Engineer of the Central Pacific Railroad, died at Shasta, Cal., this week. He was 46 years old.

O. D. WALKER, G. W. ROBINSON, JOHN WALKER and others comprise an engineering party which lately left Lawrence to survey for a railroad in northeastern Missouri.

IT is probable that Mr. A. A. ROBINSON, the present Chief Engineer and Assistant General Superintendent, will be made General Superintendent of the Atchison, Topeka and Santa Fé.

M. L. THOMSON and J. W. VANLEER, Civil Engineers, returned from Mexico by the City of Pueblo last week. They report engineering work very dull throughout Mexico at present.

CHESTER B. DAVIS, hydraulic and sanitary engineer, of Chicago, Ill., engineer for the new Fairfield, Iowa, water-works, is also preparing plans for water-works at Eau Claire, Wis., and for the sewerage of Elgin, Ill. The latter city will construct some sewers this year.

FREDERICK LOVEJOY, of Philadelphia, was elected a Director and President of the Denver & Rio Grande Railroad on the 26th. Mr. LOVEJOY is a man of large means, and was formerly General Manager of the Adams Express Company. His business connection with the express company, which had extended over about 30 years, was dissolved a few months ago. He was induced to go into the Directory and accept the Presidency of the Denver & Rio Grande by personal friends, who have great confidence in his energy and administrative capacity. His election as President was warmly urged by Col. J. C. REIFF.

When asked about the financial condition of the road, he said: "No new stock will be issued or needed. Not more than $1,000,000 will be required to put the property in first-class condition. This money has been pledged, and it will be expended in repairs, widening cuts, building protections against land-slides, and substituting iron for pile bridges."

WILLIAM A. NORTON, senior professor at the Sheffield Scientific School, died on the 21st inst., age seventy-three. He was born in East Bloomfield, N. Y., Oct. 25, 1810. Entering the Military Academy in 1827 he was graduated with honors, and was assigned to duty as assistant professor of natural philosophy at West Point. From 1834 to 1839 he was professor of astronomy and physics in the New York University. In 1839 he accepted the position of professor in Delaware College, at Newark, Del., of which institution he was also president. Thence, in 1850, he went to Brown University, where for the next two years he was professor of civil engineering. When, in 1852, Professor NORTON left Brown to assume charge of the new school of Civil Engineering at Yale College, some thirty of his old pupils at Brown followed him. This school was afterward made a part of Sheffield Scientific School, Professor NORTON being placed at the head of the Department of Civil Engineering, which position he continued to fill up to the time of his death. Professor NORTON was the author of a work on astronomy and of numerous extended articles in scientific papers, which have given him a wide reputation in scientific circles.

GEORGE DOANE ANSLEY, City Engineer of Montreal, Canada, died at his residence in that city on Saturday, the 22d inst., his death being the result of an accident occurring on the 15th. Mr. ANSLEY was born in Montreal, December 2, 1836, and after graduating from the high school, turned his attention to civil engineering, in which profession he spent his whole business life. He was assistant city engineer of Montreal for two years and city engineer for the last nine years. The Montreal *Gazette* says editorially: "In business matters his integrity and straightforwardness of purpose were well known, and all who had dealings with the department of which he was the efficient head will bear ready testimony to his honorable and straightforward mode of conducting its affairs. By all he was regarded with the

kindliest feelings. Stricken down while actually engaged in the duties of his office, Mr. ANSLEY leaves behind him a record of upright and faithful service to the city. For the widow and family, on whom the affliction has fallen with such comparative suddenness, the most sincere sympathy will be felt in their great loss." Mr. ANSLEY was elected a member of the American Society of Civil Engineers, September 4, 1878.

CORRESPONDENCE.

RAPID FIELD WORK.

EDITOR ENGINEERING NEWS:

SIR: In recent issues your correspondents record some fast leveling. Permit me to add some fast field work that came within my own knowledge.

On the N. C. M. R. R. survey in 1881 a corps of engineers in charge of Col. J. W. Andrews, M. Am. Soc. C. E., ran a preliminary line from the vicinity of Catawba River to Lincolnton, a distance of 13½ miles, in one and a half days.

The line was over a ridge country, comparatively level along a cart road which was often departed from to secure long tangents, in which case the line ran through a thick undergrowth of young oak.

The *modus* was thus: While the transitman, Capt. J. E. Price, was setting up, taking back sights, etc., Col. Andrews would select the ground, set his staff and direct the axemen toward him by carefully noting points on the line. As soon as the transitman was ready he would cause a hub to be driven, the angle taken, and start for a new line, or a continuation of former. In this way the transitman, and, in fact, every man, was kept busy continuously. The levels were carefully taken and benches every half-mile made. The leveler was Robert E. Lee, of Alexandria, Va.

Recently on a survey from McConnellsville to Cumberland, Ohio, a corps of engineers under the direct charge of the Chief Engineer, the same gentleman, Col. J. W. Andrews, ran a careful preliminary of 39 miles and 2,100 ft. in 9½ days, including ½ day in which it rained and work suspended. The ground was hilly and broken. Three summits with cuts of 60 ft. and maximum grades for 4 miles over each had to be overcome. To prove the carefulness of the survey, the location estimate did not vary from the preliminary estimates 10,000 cubic yards in the entire distance.

On another line contiguous to this a run of 5½ miles and 100 ft. was made from 7 a. m. to 6 p. m. including one hour for dinner, over two summits, elevation 340 ft., run to grade through 4 miles of wood, over a broken country showing cuts of 80 ft. and trestles of 76 ft.—a veritable broken-saw profile.

The ground was selected by eye, and in no case did Col. Andrews miscalculate his grade by more than 3 ft.

On this line the levels were carefully taken. In the last four miles the plus stations taken in leveling were from one to three in each 100 ft.

The transitman was Capt. O. A. Ransom, of North Carolina, and the leveler

Your humble servant, E. G. CHAPMAN.

Sept. 17, 1883.

VARIATION OF THE MAGNETIC NEEDLE.

OHIO SOCIETY OF SURVEYORS AND CIVIL ENGINEERS, URBANA, O., Sept. 26, 1883.

EDITOR OF ENGINEERING NEWS:

DEAR SIR: In your notice of the annual 'Report of the Ohio Society of Surveyors and Civil Engineers" you speak of the request to test the declination of the magnetic needle on Oct. 20, 1883, at 8 a. m. as if it were limited to surveyors and engineers in Ohio. Our report has been widely circulated and the request was intended to apply to any surveyor or engineer who might read it, not only in Ohio, but elsewhere as well, the object being to collect as much correct data as possible from a wide scope of country.

The western elongation of Polaris in the morning and the eastern elongation in early evening during the first part of October afford an excellent opportunity for establishing a meridian by the transit without the trouble of illuminating the cross-hairs.

The request is extended to all who may read this notice (if it please you to insert it in your valuable paper) to test the needle on the date mentioned above or as soon thereafter as may be and forward the result together with the latitude and longitude, exact or approximate, of the place of observation to Yours respectfully,

BENJ. THOMPSON,
Secretary of the Ohio Society of Surveyors and Civil Engineers, Box 862, Urbana, O.

ANDREW CARNEGIE ON THE PROSPECTS OF THE RAIL MILLS.

The following report of an interview between Mr. Andrew Carnegie and a reporter of the New York *Tribune* deserves attention as giving the opinion of an uncomonly sagacious man who has been in England so long that he may be supposed to be exceptionally well informed concerning the condition of the iron industry there as well as here.

A *Tribune* reporter called one evening last week upon Andrew Carnegie, who recently returned from Europe. Mr. Carnegie was found in his rooms at the Windsor Hotel, and upon being asked for his opinion of the condition and prospects of the steel and iron trade, he said:

"I think this: I consider that the whole world is taking a rest at present after a period of unusual activity. During this period manufacturers generally increased the capacity of their works greatly. They are now sufficient to supply the whole world, were it as abnormally active as it is the reverse. But as great loss is entailed by curtailment of production, the works are kept running to their ful capacity, although prices have fallen to figures which leave even those manufacturers who have unusually favorable facilities little or no profit, and entail a positive loss upon the average manufacturer. It is the same in England as here. One of the largest miners of coal in the world told me last month that he could only figure a profit of four cents per ton upon the coal mined by his firm. In the steel-rail manufacture the same condition of affairs exists, and the great woolen and cotton weaving houses are scarcely in better circumstances."

"Is this depression likely to continue long?"

"In my opinion no revival can take place before next spring. Much as I regret to say it, I believe that matters will grow worse for some months before manufacturing interests can reach a profitable business. A much more decided curtailment of production must take place before there can be any improvement. This will be brought about naturally by the prevalence of such ruinous prices as will compel manufacturers to stop producing goods in advance of the country's needs."

"Are the steel and iron manufacturing firms of this country sound, or do you fear a panic?"

"They are generally sound. While there may be a few failures here and there, nothing like a panic is possible among them."

"Has the change from iron to steel rails, and the consequent economy in the wear and tear of rails, made such a shrinkage in the yearly consumption on the part of old railway lines as to be felt by manufacturers?"

"No, not yet. It will no doubt be a factor of great importance in the future. At present it is not. The life of a steel rail is five times that of an iron rail, and that is five years. Now, the percentage of steel rails in use longer than five years is quite small. The steel rail has entirely taken the place of the iron rail in the United States, and yet at present, in spite of the superiority of the steel rail, it is actually cheaper than the iron rail. The depression in the former is not due to reduced consumption, for in spite of the times this year's consumption will be about a million and a half tons. This fearful depression is caused by the increase in the capacity of works generally, as I stated before. As an instance, take our own works in Pittsburgh, built in 1875 for a production of 25,000 tons. This year we produce more than 150,000 tons."

"What is the present price of steel rails?"

"About $37 per ton at the mill."

"Can steel rails be manufactured at a profit at that price?"

"Speaking generally, no. There may be one or two mills owning their raw materials—mark that, owning their raw materials—that may make fractional profits at that price."

"How about the laborers employed in steel and iron.

"Out of the twelve steel mills two have recently had disputes with their men, and the works have been stopped in consequence. Labor is all that the workingman has to sell, and he cannot be expected to take kindly to reductions of wages, even when such are necessary in order that he may have any work at all. I think the wages paid at the mills on the seaboard of the United States today are about as low as men can be expected to take. In the West, notwithstanding a recent agreement of the men to accept a reduction of 30 per cent., it now seems probable, from the very unsatisfactory outlook, that they will have to be asked for still less. In our own district of Pittsburgh our rule is to make a bargain in December with our men to govern the coming year. This rule has worked very hardly for our side for the past two years, as the market has been constantly falling. In this way our men have been and are still making much higher wages than any men either to the east or west of Pittsburgh. But a reduction of wages is inevitable in our district, though we do not apprehend that there will be any trouble about it, as our men are intelligent, and will, no doubt, deal as fairly with us now as they have in times past."

"What are your views about trades-unions?"

"We have unions in Pittsburgh, and also in all the mills west of us except St. Louis, but no mill east of us will tolerate them. We have always held that in this free country our men have a right to belong to any union they please. And up to the present hour our relations with the trades-unions have been satisfactory. I believe the trades-union is of great benefit to the men, and it has certainly developed many most able men. As a rule, the more intelligent labor is, the less difficult it is to deal with it, if capital only asks what is fair and just."

"Do you look for any protracted strikes in these interests?

"No; the situation is much too serious. Unless the market improves, our men will readily see that it is a question of work at some price or no work at all. They will, therefore, be ready to meet any reasonable demand made by their employers."

CROSSING THE MAIN RANGE OF THE ROCKY MOUNTAINS.

Northern Pacific Railroad.
Rocky Mountain Division.

TO THE EDITOR OF THE RAILROAD GAZETTE.

The location of the Northern Pacific Railroad over the main range of the Rocky Mountains presented one of the most important problems on the whole road.

Mullan pass is the lowest pass available and is about 5,774 ft. above tide-water. By a tunnel 3,850 ft. long the elevation of the summit is reduced to 5,548, and the total ascent from "Ten Mile Creek," two miles west of Helena, to the summit is 1,668 ft.

The distance by the most direct valley is about 13 miles. It was desirable to use a maximum grade not exceeding 116 ft. per mile. In running a line eastwardly down from the proposed tunnel along the most obvious route very considerable detours were required in order to cross the large and deep valleys making down from the mountain side.

One crossing of 221 ft. high being much the most formidable of all, surveys were made with a view of crossing the valley nearer its source, but very serious difficulties were encountered.

At length the idea was developed of turning backward along a slope which is not very steep until the bottom of the main valley was reached. This scheme turned out favorably, and by lengthening the line about 3,000 ft. the cost of construction was reduced over $250,000.

The scenery along this part of the line is exceedingly interesting, abounding in great contrasts and pleasant surprises. There are no doubt some wilder and more imposing views on some of the less frequented railroads, but it is doubtful if any of the great thoroughfares of the country can convey more pleasurable emotions to the mind of travelers. J. T. DODGE, Division Engineer.

THE LOST LEDGE.

A few days since the *Reveille* spoke of the early days of Big Creek and its failure as a mining camp. Ledges were there, but they were so base that no known process could make them profitable, and so Big Creek became deserted as a mining center. But the greatest failure or rather mystery known to the annals of mining, is the loss of the Whitlach Union ledge. The mine is over in Marshal cañon, and over a mile and a half from town. In early days it was discovered and opened out. Just imagine a ledge between 7 and 8 feet thick of $200 ore! Yet fabulous as this seems, the Whitlach Union had just such a ledge. It was like mining $20 pieces. A fine hoisting works was erected, many men were employed, the mine opened out systematically and the owners were preparing to sit back and enjoy themselves in elegant ease, for nothing like it had ever been heard of before. Everything went along swimmingly for a little while until one day the miners came to a break in the ledge. It was as good as ever up to the break, but it suddenly stopped and the break was as clean

and complete as if it had been cut with a knife. Beyond and all around was nothing but barren rock. Of course we can find it again, thought the owners; it has only slipped off during some earthquake or other commotion of nature, and a few days' prospecting will bring it to light. Full of this idea they commenced prospecting, and they kept prospecting until thousands of feet of drifts and shafts had been run and sunk, and fortunes spent, but still no ledge. Nor has it been found to this day, now many years after. A large standing reward has been offered for its discovery, but the hills have so completely buried their secret that the most prying inquisitiveness of the most experienced miner has failed to get it. Theories of all kinds have been advanced, and many of them put to practical test, but all in vain; the Whitlach Union will not reveal its hiding place. It is a very common thing for the Manhattan ledges to break off in the same shape, but the miners know just where to go and pick up the other piece of it. The same tactics, applied on the Whitlach Union, utterly failed to discover the lost ledge. When it quit it was not very deep, and the surrounding country has been so thoroughly honeycombed by miners searching for it that it seems pretty clearly established that it is not anywhere near the portion that was worked out. But where is it? Some of these days it may be stumbled across just as a lucky miner finds a nugget. Until that time it will be spoken of as the lost ledge—forming a mystery unequaled in the history of mining.—*Austin Reveille.*

WHAT A WESTERN CITY PAYS ENGINEERS.

We find the following in the Minnesota *Tribune*:

The office of city engineer dates back to the incorporation of Minneapolis as a city. The engineer has charge of all public improvements except those conducted by the water department, including the laying out of streets and their paving, the building of sewers and bridges, etc., and is appointed by the Common Council. His salary is $3,500 per annum, and the incumbent is allowed three assistants, two draughtsmen, three levelers and one rodman, all of which are paid by the city. The total amount paid this department per year is as follows:

	Per year.
City engineer	$3,500
First assistant	1,800
Second assistant	1,500
Third assistant	1,200
Two draughtsmen	1,800
Three levelers	2,700
One rodman	720
Incidentals	1,000
Total	$15,220

The cost of the water works is as follows:

The board of water commissioners was constituted in 1881. It is made up of four members, each of whom are paid an annual salary of $150. The mayor is ex-officio president of the board, and the superintendent of the water works is secretary. Previous to 1881 the control and supervision of the water works, the mains, pipes, supplies, etc., were within the jurisdiction of the common council. In the spring of that year this body was relieved of the duties appertaining to the water works system, and the authority delegated to the powers herein referred to. The salary list of the department per year is as follows:

Four commissioners	$800 00
Supt. water works	2,000 00
Superintendent clerk	1,100 00
Engineer pump house	1,800 00
Assistant engineer pump house	1,200 00
Two watchman pump house	1,680 00
Street service foreman	1,200 00
Assistant foreman	800 00
Chief inspector	1,000 00
Two assistants	1,680 00
Three laborers (each) $1.75 per day	1,638 00
Total	$14,698 00

The offices are appointive.

CHINESE MEASURES.

A writer in the *North China Herald* gives some curious information respecting the foot-measures in China. At present it varies largely in different parts of the country and according to different trades; thus the foot of the carpenter's rule at Ningpo is less than 10, while that of the junk-builders at Shanghai is nearly 16 inches. But a medium value of 12 inches is not uncommon. The standard foot of the Imperial Board of Works at Peking is 12⅛ inches. A copper foot-measure, dated A. D. 81, is still preserved, and is 9½ in. in length. The width is one inch. The small copper coins, commonly called cash, were made of such a size, sometimes, as just to cover an inch on the foot rule. In the course of two centuries it was found that the foot had increased half an inch, and a difference in the dimensions of musical instruments resulted. Want of harmony was the consequence, and accordingly in A. D. 274 a new measure, exactly 9 in. in length, was made the standard. Among the means employed for comparing the old and new foot are mentioned the gnomon of official sun dials, and the length of certain tubes used according to old regulations as standards. One of these latter was so adjusted that an inch in breadth was equal to the breadth of 10 millet seeds. A hundred millet seeds, or 10 inches was the foot. The Chinese foot is really based on the human hand, as is the European foot upon the foot. It strikes the Chinese very incongruous when they hear that we measure cloth, wood work, masonry, etc., which they regard as especially matters for the hand, by the foot. Of the jade tubes above mentioned there were 12, and these formed the basis for the measurements of liquids and solids 4,000 years ago. They are mentioned in the oldest Chinese documents with the astrolabe, the cycle of 60 years, and several of the oldest constellations. It is likely that they will be found to be an importation from Babylon, and in that case the Chinese foot is based on a Babylonian measure of a span, and should be 9 inches in length.

NEWS OF THE WEEK.

SALT LAKE TO RED BUTTE CANYON is the title of a projected road. As it will cross a military reservation, the consent of Congress must be had.

TEXAS, SANTA FE & NORTHERN.—This road was inspected lately from Santa Fe to Espanola, by C. H. Irvin, Chief Engineer, and W. H. LeCount, Superintendent of the Tie and Timber department, accompanied by Ed. F. Brown, the contractor for the bridges and track laying. The high water in the Rio Grand has strengthened the bridge by depositing a large amount of sand and gravel, in some places 5 feet aronnd the piles.

CONTRACTS LET.—The directors of the Chicago & Western Indiana Railway Company awarded the contracts for the construction of the new Western Indiana depot, corner Polk street and Third avenue, Chicago, as follows: Masonry and plastering work for the whole building; carpenter and joiner work, E. Hudson; iron work, H. A. Streeter, of Globe Iron Works; steam-heating, Fred Tutor & Co.; roofing, Knisely & Miller; painting, J. B. Sullivan & Brother; terra-cotta, Perth Amboy Terra-Cotta Company.

According to present estimates the new depot will cost about $500,000.

THE MINNEAPOLIS & ST. CROIX.—This company is now being organized. It was doubted whether it would be feasible to cross at Hudson, Wis., and passing up Willow River Valley, instead of going up to Big Rock Creek, was mooted, and Gen. Washburn thought so favorably of it that he will probably have the engineers make the survey, as they now have a large corps running lines in all directions north of Hudson.

THE AMERICAN INSTITUTE FAIR.—Busy preparations are going forward for the fifty-second annual fair of the American Institute, which will begin next Wednesday in the Institute building, at Third avenue and Sixty-third street. The promoters of this exhibition say that it will be exceedingly interesting in the matter of machinery and electrical invention. Among the novelties will be several new gas motors. Eight varieties of steam engines, of new types and varieties, it is stated, will be on view. There will also be a machine by which all of the ice used in the building will be manufactured. The departments are gradually assuming definite form, and pains will be taken to make them as attractive in appearance as possible. Special attention is being paid to the exhibits of house decorating materials and patterns. A noticeable feature of the fair will be the total absence of sewing-machines. Mayor Edson will deliver the opening address at 2:30 o'clock p. m. on Wednesday, and Conterno's band will furnish the music. Concerts will be given every afternoon and evening during the exhibition.

A BIG River and Harbor Bill is expected to be passed in the next Congress.

ST. PAUL (MINN.) CONTRACTS.—The following contracts were awarded at last meeting of the Board of Public Works:

Grading Herman street, between Seventh street and Edge of the Bluff, Michael O'Toole, $3,000; John D. Moran, $4,010; James Murhane, $3,486. Awarded to O'Toole.

Sewer on Canada street, between Fourteenth and Valley streets, Warne & Stockton, $2,100; Charles T. Miller, $2,200; John Doherty, $2,437. Awarded to Warne & Stockton.

KANSAS IRRIGATING COMPANIES.—The charter of the Kingman County Irrigating and Manufacturing company has been filed in the office of the Secretary of State. The purpose for which the company is formed, is the construction and maintenance of dams, races and canals for waterworks irregation and manufacturing purposes along the Ninnescah and Chikaskia rivers in the county of Kingman.

KANSAS CITY CONTRACTS have been awarded as follows: Constructing a sewer in district 49, it being an extension of the Hickory street sewer, West Kansas, from Eleventh street to Kansas avenue; let to Thomas Appleton of Leavenworth for $11,525. Curbing and guttering Central street, from Seventh to Eighth, Thomas Lyon; sidewalks on Highland avenue, from Twelfth to Fourteenth streets, Thomas Kneaves; on Eighteenth street, from Main to Grand avenue, T. M. Folkes; on Charlotte street, from Fourteenth to Fifteenth, Thomas Kneaves; on Grand avenue, from Eighth to Ninth streets, G. A. Libby; curbing Seventh street, from Wyandotte to Delaware, James Lyons; curbing the west side of Delaware street, seventy-two feet south from Seventh street James Lyons.

ENGINEERING IN BOLIVIA.—A committee of engineers is about to assemble at Oruro to definitely decide as to the route to be adopted for the railroad which is to connect the interior with the Pacific coast.

THE KANSAS CITY AND IOWA ROAD.—A letter in the *Kansas City Times* states that this road is being organized. The proposed railway will run on almost an air line from Kansas City to Des Moines, Iowa, through Clay, Clinton, DeKalb, Gentry and Worth counties, in Missouri.

A HORSE CAR INCIDENT.—The time was midnight and the situation near the *World* office. The man was fearfully and wonderfully full. He walked up to the fire-alarm signal-box and placed a nickel in it. Then he sat down on the curb.

"Why don't the car start?"

He received no answer.

"Why don't the car start?"

Still no answer.

"Gimme back me fare, then!"

It was not returned.

Then he jumped up, grabbed the telegraph pole around the waist, and attempted to trip it up. There was a spirited tugging for several seconds, and then he made a terrific kick at the "feet" of his adversary, and the result was that he kicked himself over on his own head.

As he excutivized himself he moved off, saying:

"Yer a smarter conductor than I thought yer wuz, but I believe now that I'd a throwed yer if yer coat hadn't come off."—*New York World.*

EIGHT CLERKS TO MAKE THE FREIGHT RECEIPT.—A correspondent of the Indian *Railway Service Gazette* says:

"I had occasion the other day to book goods from the goods shed at Madras, and I had to go to *eight* clerks before I finished with my work. Surely this, I should think, was quite unnecessary and useless, and all this work could have been done by two men instead of eight. Each of these eight men had only to write a few words, and some a few figures, and the eighth or last man had merely to sign his name to the receipt, which took seven men to make out. All these clerks, I presume, are in receipt of monthly salaries for doing but very little, according to what I have seen done on that day with my goods. Is this one of the many reasons why the Madras Railway does not pay? I am certain that it does not take eight clerks to book a box or bundle of goods on any other line in India save the Madras Railway."

WATER-WORKS INLET CONTRACT.—The town of Lake, Ill., has let the contract to construct a three-strainer inlet crib to the water-works for the sum of $15,000 to Bates & Hean, the work to be completed within thirty days, weather permitting.

THE ATCHAFALAYA BRIDGE.—The piers have been sunk with the exception of two small ones. The pivot pier in the center of the stream is finished, and is now ready for the superstructure. The span on the west side of the Atchafalaya has been completed. The engineers say that it will not be difficult to sink the two small piers, as the low stage of water in the river will enable them to work. The iron for the superstructure is on the ground, and a force of bridgemen such as Capt. Anderson has charge of will put it in place in a very short time.

IMPROVING THE RIVERS OF OREGON, ETC.—One effect of the completion of the Northern Pacific Railroad will be the necessity of improving the navigation of the rivers of Oregon and Washington Territory. The Willamettee especially demands work at once to clear it of bars and allow ocean steamers a fair channel, even as far as Portland. It is estimated that $350,000 is needed for this purpose alone. Other navigable streams will require aid equally important.

CAPE COD SHIP CANAL CO. — President, Wm. Seward, Jr.; Vice-President, J. T. Hoile; Treasurer, Samuel Fessenden; William Howland, Secretary. Directors in addition to above are W. A. Clark, Geo. S. Hall, Edwin Reed, and John Styles. The engineers are Geo. H. Titcomb, Chief; Geo. Wright, Assistant Chief; Chas. M. Thompson, in Charge of Bridge Department. The contractors for entire work are Alfred D. Fox & Co., Montreal, Canada.

THE WYOMING VALLEY WATER CO.—HARRISBURG, Sept. 20.—The Wyoming Valley Water

Company, formed for supplying water to the public in the Wyoming Valley, was chartered to-day. The capital stock is $50,000 and the principal office is to be located in Wilkesbarre. The Kinzua and Elk Township Natural Gas companies, of Warren County, were also chartered.

THE PLEASANT VALLEY LAND AND WATER CO., Cal., has incorporated. Its capital stock is $100,000. The directors are C. A. Warren, J. W. Bryan, J. W. McDonald, W. R. Sloan and I. F. Eaton.

THE VICKSBURG WATER-WORKS.—VICKSBURG, Miss., September 18.—At a meeting of the City Council last night, it was resolved to give the North American Construction and Improvement Company of New York sixty days more to commence active operations on the water-works of this city; otherwise their contract shall be forfeited. Six months have elapsed since the execution of the contract, and no work as yet has been done. The contract specified that operations shall commence within ninety days after the execution of the same, and the work to be completed in twelve months.

OHIO RIVER R. R.—Tracklaying begun on this road Sept. 12. There are 90 miles to lay to Wheeling, W. Va. The Chief Engineer is Wallace McGrath, and the office of the company is at Parkersburg, W. Va.

KANSAS CITY (MO.) CONTRACTS.—A contract for making sewer in District 91 was let to T. Fisher, for $6,523. For paving Penn street, the bids were as follows:

	Per sq. yd.
E. Sexton	$2.31½
B. A. Taylor	2.48
Jaicks & Thacher	2.48¾
G. O. Bishop	2.58
Comstock & Halsey	2.59¾

The *North American Review* for October presents a most attractive table of contents. Senator N. P. Hill writes of "Gold and Silver as Standards of Value," and maintains that silver should be coined as well as gold, not for the purpose of inflating the currency, neither in the interest of the silver-mining industry, but for the broader and more equitable purpose of preserving uniformity in the value of metallic money, and of preventing such contraction of the volume of money as would produce financial disaster. In "Some Aspects of Democracy in England" A. V. Dicey makes clear to the American reader how it is that while all the forms of monarchy and aristocracy persist in Britain, the democracy, or, in other words, public opinion, absolutely controls the action of the government. Under the title of "Co-operative Distribution," the Rev. Dr. R. Heber Newton gives an instructive historical sketch of the rise, progress and fluctuations of co-operative merchandising in the United States during the past fifty years. Prof. W. Boyd Dawkins writes of "Early Man in America," whose mode of life and whose implements appear to have been identical with those of the races that contemporaneously inhabited the Mediterranean countries, the Nile basin, and the tropical forests of India. The possibility of "Astronomical Collisions," whether of the fixed stars with one another, or of comets with the sun, the earth, or the other planets, is considered by Prof. C. A. Young. Moncure D. Conway discourses learnedly, and at the same time most entertainingly upon the "Saint Patrick Myth." Van Buren Denslow, in an article on "Board of Trade Morality," makes a vigorous defense of the pratices of the Corn Exchange, and in particular replies to the strictures of Mr. Henry D. Lloyd, contained in the *Review* for August. Frederick Harrison contributes an article, invaluable to the historical student, on "Histories of the French Revolution." Finally, the Rev. E. E. Hale presents an inventory of the volume and distribution of "Social Forces in the United States." Published at 30 Lafayette Place, New York. $5,00 a year, 50 cents a number.

PAPER PROJECTS.—Two Indiana roads that were to be the Indianapolis Eel River & Southwestern and the Terre Haute Belt Road do not seem to amount to anything. Construction companies that went to the expense of putting in bids are disgusted.

CORNELL UNIVERSITY.—The new course in electrical engineering opens favorably.

ROEBLING'S WIRE-WORKS CLOSED.—The rod mill of John A. Roebling's extensive wire-works at Trenton, N. J., closed on the 25th, and about 90 men are thrown out of work. The cause is the dullness of the wire trade. There is little doing in the wire department of the Trenton iron-works either and many hands are idle.

THE HARTFORD & HARLEM RAILROAD COMPANY received a check by the recent decision of the Commissioners allowing priority for the New York and Connecticut Air Line. But they are not to be put down, and already a new survey has been begun at New Haven for a new lay-out, and the stakes have been driven. Few people know the direction to be taken by the Hartford & Harlem, other than those through whose land the lay-out passes. In spite of the obstacles which have been laid in their path, there seems to be a determination to lay the rails of the Hartford & Harlem somewhere, and it is thought that energy and patience will finally accomplish that result.

RAILROAD BUILDING IN MEXICO.—A line is to be built from Mazatlan to Navarette. The National Railroad has suspended work at Saltello.

SURVEYS BY SUBSCRIPTION.—Great efforts are being made by the St. Louis & Kansas City Air-Line, a new company lately incorporated, to secure aid from the various counties, towns and villages in Missouri through which it is to run. The company succeeded a day or two ago in getting the town of Fulton to vote $10,000 towards a survey. The road is to run in an air-line from St. Louis to Kansas City, crossing the Missouri twice just west of St. Charles and near Boonville.

A NEW COURT-HOUSE.—JOLIET, Ill.—The Will County Board of Supervisors have decided to build a new $150,000 court-house.

VICKSBURG HARBOR.—Dredging has been suspended for the present. Col. Rittenhouse Moore had contracted to complete the work, and has filed a paper asking the Government to extend the time until the 30th of next June. There is only about four-tenths of the work estimated to be done in the basin and canal, and only one-seventh of the entire work estimated for the canal and basin, and canal leading to Klemstone, completed at present. There remains of the $100,000 for the improvement, $60,000, which has not been spent. A survey is now being made of all the inner harbor by a large force, so as to present to the River Commission at their next meeting a complete showing of the amount of filling.

THE CANADIAN PACIFIC.—A letter from Montreal says that grave rumors are circulating there respecting the success of the Canadian Pacific Railway. The exodus from Manitoba this season has reached alarming proportions. The heavy freight charges imposed by the railroad and the severity of the winters are said to have made living so expensive that many people have decided to leave the country.

AN EXPENSIVE EXPLOSION.—By a gas explosion in the extensive Oxmoor iron furnaces, six miles north of Birmingham, Ala., the engine-house and other valuable property were burned. The estimated loss is $500,000. It will take a long time to rebuild the works, which are owned principally by a Cincinnati company.

THE Fond du Lac, Amboy & Peoria is to be widened by the Milwaukee & St. Paul, which has recently purchased it.

SHIPMENTS of railway material are going on from Galveston for Pescadavia, Mex., to be used in the construction of the Mexican Division of the New York, Texas and Mexican Railway. The material is being shipped on light-draught schooners, as the depth of water in the harbor of Pescadavia does not exceed five feet.

LITCHFIELD, ILL., GAS WORKS.—The Council has given Kressler & King the right to erect gas works, etc., while an exclusive right has been given to other parties to supply natural gas.

ELECTRIC LIGHT FOR LOGANSPORT, IND.—It was decided at a late meeting of the council to use not less than 50 Jenny electric lamps. The cost will be only $5,000 per annum.

CHEAP WATER-WORKS.—The village of Winthrop, Maine, has just completed a system of water-works at a cost of only $5,000. There are 3,400 feet of eight-inch pipe with eight hydrants and twelve hundred feet of fire hose.

EASTHAMPTON, Mass., is still without water works. Measurement has been recently taken of Turkey brook, and its flow is found to equal 140 gallons per minute. This is an ample supply for the town with reservoirs. It is thought that private citizens would furnish the necessary capital for the water-works.

BOSTON WATER.—The Boston Water Board was authorized to expend $10,000 in removing the sources of pollution from the Mystic water supply.

WATER-WORKS CONTRACT.—Mattoon, Ill., Sept. 22.—After several months' agitation the City Council has awarded the contract for the construction of city water-works, Jesse W. Starr, of Philadelphia, receiving the award. The works will probably cost $75,000.

THE government survey of Stanford Harbor (Conn.) is progressing.

CHEAP GAS IN TEXAS.—The party of St. Louis capitalists who own the Palestine (Tex.) water-works, now ask right to build gas works.

A VERY hot place to live in seems to be, according to a correspondent, Dos Palmos and Fink's Springs, a depression of 264 ft. below sea level—evidently the bed of a lake long ago dried up. He says of it: "What a change from 11,000 ft. above sea at Marshal Pass! Hot, did you say? It was 119 in the shade. The buildings through all this region are double roofed, to break the intense heat of a vertical sun. The great Colorado desert, about 150 miles wide, was crossed yesterday afternoon and last night. The winds over the sands are like those from a furnace. Great drifts of sand, pure and white, are seen all over the desert."

THE NEW ORLEANS ELEVATED R. R. surveys are now completed. The engineers estimated the cost of the road and depot at $2,760,000. The general opinion was that it would cost $10,000,000.

THE BERLIN IRON BRIDGE CO., of East Berlin, Conn., is running their works day and night, 22 hours per day, employing 200 men. They expect to turn out 100 spans of Iron Highway and Railroad bridges during this year and are making many additions to their plant.

A NEW road from St. Louis to Kansas City, Mo., is projected. This road is to run through St. Charles, Montgomery, Boone and Callaway Counties, and thence on through Howard, Saline and Jackson Counties to Kansas City.

ELECTRIC LIGHT IN MINES.—A number of Arizona mining companies are about to adopt the electric light to facilitate operations underground as well as on the surface, notably the Silver King Mining Company, the Howell Smelting and Mining Company and the Conger Mill and Mining Company. At the Silver King mine it is proposed to use four 3000 candle-power arc lights above ground and two below, together with twenty-five small incandescent lamps.

THE NORTH ADAMS (MASS.) WATER-WORKS.—The water question is being agitated and artesian wells have been suggested, by experts. It is thought that by going down 150 feet a sufficient flow of water would be found to supply the town. Dr. Loring expressed the opinion that wells could be sunk with profit as the natural reservoirs on the mountain sides must pass under the valley where the town is situated. There is a strong desire among the citizens to spend some $2,000 in the experiment before using $100,000 on the new Clarksburg reservoir. The water supply for the town is now very low, and something must be done about it.

THE AQUEDUCT COMMISSION.—The expenses up to Oct. 1 are estimated at $11,397.77, and $15,075 additional will be required up to Jan. 1. The borings to find the best route across the Harlem River cost $993.

CONTRACTS FOR PURE WATER.—The Sinking Fund Commissioners N. Y. did no business. They have agreed to hear statements next week relative to the act of June 2, 1883, which authorizes the commissioners to make contracts with any corporation for the daily delivery of not less than 50,000,000,000 gallons of pure water from the district embraced in the counties of Rockland and Orange.

THE CHICAGO ROCK ISLAND and Kansas City Railroad Company started out their surveying corps from Chillcothe Mo., on the 24th for the third time and re port says they mean business.

EAST WEYMOUTH (MASS.) WATER SUPPLY.—A meeting was lately held to enable the town to take a water supply from Weymouth Great Pond. The expense would be a total of $300,000.

ELECTRIC LIGHT FOR PROVIDENCE, R. I.—The American Electric and Illuminating Company has opened a fine station.

MUDDY RIVER (CONN.) IMPROVEMENT.—$200,000 had been appropriated for the purchase of lands, but the order is to be reconsidered.

CONTRACT LET.—The contract for furnishing an iron roof for the pumping station at old Harbor Point, Mass., has been awarded to David H. Andrew for $10,416. The other bid was $15,000, made by the G. W. & F. Smith Iron Company.

THE CITY ENGINEER OF LOUISVILLE made F. Zable, a contractor, take up granite pavement and relay it.

SURVEYORS are trying to find a new layout in New Haven for the Hartford & Harlem road.

SEWER CONTRACTS LET.—The bids for building sewers in Waterbury, Conn., were opened last week. Moses S. Austin, of New Britain, bid $5,979 for all the work, and was awarded the contract. Matthew Kehoe's bid was $6,067.25.

STEEP RAILROAD GRADES.—There are some steep grades on railroads in Arizona. In fact "railroads" seems a misnomer, and they might almost as well be called "elevators." The largest of these rises 1,100 ft. in a length of track of 3,000 ft., in which, however, but 2,790 ft. of horizontal distance is made, making the grade nearly 40 per cent., or about 2,100 ft. per mile; another exceeds this, however, a track 1,500 ft. overcoming an elevation of 700 ft., which is at the rate of 2,770 ft. per mile (52¼ per cent.); and a third, which rises 580 ft. in going 1,200 ft.

HUMBOLDT (Ill.) is agitating the question of a water supply.

CHICAGO STREET CONTRACTS.—Contracts for street improvements costing over $100,000 have been let as follows: To George W. Wilson, on Clark street, from Madison to Randolph; Conway & McAdam, Clark street, from Jackson to Madison; John E. McMahon, Clark street, from Randolph to

Chicago River; John E. McMahon, Wabash avenue, from Lake street to Rush street bridge; J. Hodgkins, Wabash avenue, from Madison to Lake street; Jacob & Lansing, Madison street, from Franklin to Chicago River; George W. Wilson, Madison street, from Clark to Franklin. Work is to commence by the 1st of April, 1884, and be completed on June 1, 1884.

EXPANSION OF PORTLAND CEMENT.—They are taking down the front wall of a five-story brick building at South and Essex streets, Boston. Mr. Bradlee the architect, attributes the bulging of the wall to the use of Portland cement. He says: "This cement has been used mostly in constructing water-works and other like structures, and has not been used much where it has been exposed to the air. It was only about a year ago discovered that this cement would expand under these conditions." Some interesting experiments have been made in Mr. Bradlee's office. Three glass bottles were filled with Portland cement and sealed tight. One burst in two days, one in eight days, and the third in ten days—proving that the cement does expand.

THE THOMASTON (CONN.) NEW TOWN HALL.—A. I. & G. S. Chatfield do the mason work and George Tracey the wood work on the new Town Hall at Thomaston, which is to cost $50,000. Both are Waterbury contractors.

THE TEMPERATURE OF TUNNELS.—A Geneva correspondent of the London *Times* remarks that at the instance of the Simplon Railroad Company a commission of experts have compiled and published an interesting memoir of the geological condition of the Simplon, with special reference to the temperature of the proposed tunnel. The temperature of a tunnel depends chiefly on its length, character of the strata through which it runs and the thickness of the superincumbent mass. In the St. Gothard tunnel the temperature often rises to nearly 90° F. In the proposed Mont Blanc tunnel it will probably be about 120° F., and and in the Simplon tunnel, if the trace projected in the year 1877, which passes through Mont Leone, were adopted, might be about 118° F. It is now proposed, however, to adopt another line of operation, which, though it would be a curve and would make the tunnel considerably longer than was contemplated, offers several important advantages as compared with a straight line. It is estimated that the normal temperature of the tunnel on this line would not exceed 95° F., and as the nature of the ground would admit of the sinking of two shafts the temperature might be considerably reduced.

BRIDGE BUILDING ON THE BEE LINE.—On the Indianapolis & St. Louis Division of the Bee Line system there have been the entire season 160 stone masons and 433 carpenters employed in putting in stone work and rebuilding bridges and trestles.

DOUBLE TRACKS AND DOUBLE BRIDGES.—NEWARK, O., Sept. 21.—Active work has begun on the double track between this city and Columbus; and a large force of men are at work. A gang of men are also at work on the Columbus end of the road grading, etc. The work is being done under the supervision of the Baltimore & Ohio and Pan Handle Companies. All the bridges between here and Columbus will be removed and replaced by double track iron bridges.

ST. PAUL & EASTERN GRAND TRUNK.—Ex-Congressman Pound is taking great interest in the completion of this road. The line begins at the city of Oconto (Wis.). Ten miles are built twenty miles more are let. The route is from Oconto to Shawano, on Wolf River, thence to the Wausau, on the Wisconsin River; thence to St. Paul, the exact location from Wausau to St. Paul not being decided as yet. From Oconto a branch road will extend down Green Bay to Marinette and Menominee via Peshtigo.

THE ATCHISON, TOPEKA & SANTA FE.—The line is being rapidly built between Wichita (Kan.) and Kingman City on the cut-off to Dodge City, thus avoiding the great bend of the Arkansas River. The bridge crossing the great Arkansas will be begun at once.

BUSY MEMPHIS.—At this moment there is a marked revival of interest and activity in every branch of business, the natural consequence of an exceptionally healthy summer. The sound of the hammer and trowel resounds on every side. Bricklayers demand and receive their $4 per diem, and are hard to get at that. If the much-boasted boom is not apparent to the uninitiated in any other shape it certainly is visible in a brick and mortar eruption that has broken out all over the city. Many fine residences and a score or more of new stores testify to the existence of capital and the demand for accommodations, while the erection simultaneously of four large and costly churches bears witness to the fact that the Bluff City is not completely materialized yet. As shown by the clearing-house statement for the week, the business of the city increased 129 per cent. over the same week last year. Capital is abundant, and loans are readily effected at the current rate of 8 per cent. on good security. Memphis partakes largely of the character of a cotton mart, and 400 bales were sold here yesterday, spinners being the purchasers. To remove any lingering doubt of her activity, Memphis has recently added a chewing-gum factory to her manufactures. Importers were unequal to the call upon their resources. Retail dealers collapsed in despair. Everybody chews here except people with false teeth and babies with none. When I first arrived, with all my worldly goods in a gripsack, I found the universal activity of the universal jaw something painful to contemplate; but familiarity (which breeds indifference as often as contempt) now enables me to gaze with unconcern upon the convulsive twitching of the softly tinted cheek of a ruminant belle, or listen with stoical patience to the jerky utterances of the hotel clerk. The supply of gum is now equal to the demand, and dealers are serene.—*Correspondence of N. Y. Tribune.*

THE ST. LOUIS BELT ROAD.—The survey of this road, which, it is said, Vanderbilt wishes to purchase, has been begun, and track laying began on Monday last.

A NEW TELEGRAPH COMPANY.—The International and Northern Telegraph Company has been incorporated at Albany with a capital of five millions.

THE SALINA & FREMONT.—The projected road from Salina, Kan., to Fremont and the projected road between Decatur and Cherokee have been merged and the system somewhat extended. The Lincoln *Journal* says: The proposed line begins at Salina. It runs in a direct northeasterly course to the Nebraska line, thence passing through Beatrice, Lincoln and Fremont to Oakland, thence to Decatur. From Decatur a line is projected to Spencer, Ia., where connection is made with the great Milwaukee line. At Cherokee, Ia., it crosses the Illinois Central Road. At Oakland it connects with the St. Paul and Omaha. At Fremont it intersects the Sioux City branch of the Northwestern, as well as the Union Pacific. At Lincoln it touches the heart of the great Burlington and Missouri system.

DELAWARE WATER GAP & PORT JERVIS R. R.—This is a new line—said to be backed by strong capitalists, and very popular with the people of the region through which it runs—now being surveyed between the points above named. Engineers Tuisman and Miller are in charge of the survey.

NEW WATER-WORKS are in course of construction at Sioux City, Iowa, and Chamberlain from plans projected by Wm. C. Stripe, C. E., Keokuk, Ia.

NEW ROAD IN ARKANSAS.—A number of capitalists contemplate extending the Eureka Railroad to Harrison.

A BIG CONTRACT.—John R. Wherry, of Little Rock, Ark., has secured the contract for $40,000 worth of stone, to be used on the jetty works on the Mississippi.

LEVEE CONSTRUCTIONS.—ARKANSAS CITY, ARK., September 23.—Maj. A. Shyner, with a full corps of engineers, is here awaiting the arrival of Maj. Starling, of the River Commission Engineer Corps, to begin the work of surveying the levee from this city to the high lands on the Amos Bayou. Maj. Starling will arrive to-night on the steamer Commonwealth, and active work will begin to-morrow or Tuesday.

COSMOS, ST. CHARLES, MO.—The construction of a levee from the bluff three miles below Augusta to Femme Osage Creek for the protection of lands in Darst Bottom, will cost, according to the estimates of the surveyors, about $8,000, or about $1 an acre for the land protected.

THE GEORGETOWN & LANES RAILROAD, connecting Georgetown, S. C., with Lanes, a point on the North Eastern R. R. of South Carolina and the South Eastern terminus of the South Carolina Central R. R., is now running trains from Georgetown to the end of the track, 20 miles; the remaining 17 miles are all graded and the trestles built; the cross ties are all on the road ready for the rails, which are furnished by the Bethlehem Iron Co. This road was commenced last December. The entire contract to build, furnish and equip the road was awarded to Mr. A. J. Twiggs, of Augusta, Ga. All the freight cars were built in Georgetown. The track will be laid and the road turned over to the company by the 1st of November ensuing.

THE survey of the Duluth, North Shore & South Western will begin at once. The corps of engineers will be put on the line about October 1.

THE Vicksburg levee meeting will take place Oct. 1, and a large number of delegates will be present.

A SUIT FOR GRADING.—The lowering of grade in Kansas City (Mo.) has induced a proprietor of a natatorium and Turkish bath to put in a claim against the city for $30,000.

AN ELECTRIC EXPERIMENT.—Dr. Wellington Adams, the electric scientist of St. Louis, met with a narrow escape of his life while experimenting with an electric motor, which flew into thousands of pieces, seriously injuring Mr. W. D. McQuesten, connected with the Wellington Adams Electric Company. The motor was going at the rate of 3,000 revolutions per minute.

WASTE OF CHICAGO WATER.—A gentleman writes to the *Tribune:* "I had some experience a short time last fall as Water Inspector on the South Side. So far as the water supply is concerned, it is ample at present, being 75,000,000 gallons per day. The fact is, there is one-third of the above large amount of the water supply 'actually wasted' in every possible way—by servants, employés, lawns, steps, sidewalks, windows, watering-troughs, liveries, street sprinklers, and every device for wasting water. The avenue people forget that other people need water south of Twenty-first street. It takes from 50 to 100 barrels to use on one carriage alone. Liveries are hard on water, and sprinklers on streets the worst of all—at the hydrants and on the streets. Even the crossings are flooded, making it exceedingly unpleasant for women to cross."

A NEW phase of competition has lately shown itself among railway syndicates, viz.: disputes over some branch or projected road. Such a contest is now going on in Minnesota between the Winona and the Northern, and the A. B. Stickney syndicate. The Winona people carry the cash right along with them and pay for the right of way as they go, without stopping to quibble over the price asked. By pursuing this policy they secured the right of way through Stockholm in twenty-four hours.

IRON AND METAL MARKET.

PHILADELPHIA, SEPT. 27.

The character of the pig iron market is still unsatisfactory, and the bulk of business is restricted to small lots for current requirements. A number of offers have been made for inferior gary forge iron, but nothing has been done in a large way. Offers are generally 25 or 50c. below makers' terms. A large amount of mill iron is going into consumption, but the deliveries are for weekly requirements for the most part. Gray forge ranges from $17@$18.50 at furnace. Foundry, $21.50 @$22.50 for No. 1, and $20 is the average price paid for No. 2. Five thousand tons of Bessemer pig sold at $21, and 10,000 tons are under negotiation, and will probably be closed for at the same price. Spiegeleisen is wanted at $30@$30.50. A few thousand tons have sold this week, and other lots are likely to be ordered before the close of the week. The dull demand for refined iron continues, owing to the downward tendency. Large buyers still hold off, although prices range from 2@2.10c. in large lots, and 2.10@2.20c. in retail lots. The supply is in excess of demand, and the outlook is not encouraging for firm prices. Nails are somewhat weaker, and sales have been made at $2.90 in car-load lots. Western nails are offered at that price here, and, in some cases, at less. Engineering requirements for construction iron are very large, and mills on plates and shapes are doing better than others. Steel rails are without change, and no large transactions are reported.

PITTSBURGH.

Quotations in Western Pennsylvania are $20@$21 for best No. 1 foundry; $18@$20 for No. 2; $21@$21.50 nominally for Bessemer pig; $17.50@$18.50 for gray forge; merchant bar, 1.80@1.90c.; muck bars, $33@ $33.50; nails, $2.65@$2.90; steel rails, $38@$39, in small lots; $37 has been named for winter orders in large lots; scrap is unchanged.

The tone of the market is improving. A number of heavy transactions in forge have taken place, deliveries to be made during the rest of this year. Foundry irons are moving slowly and the demand is fully equal to all requirements.

The question of the wages of window glass workers is being considered to-day by the Cleveland convention.

The coal trade is active, and there is full production, with rumors of strikes for an advance in wages, which operators will not concede without a contest.

CHICAGO.

Merchant bar-iron is in fair request, and a little firmer in large lots, than when last reported. Quotations are 2.05@2.10c. Hoop iron is weak. The demand for structural iron is keeping prices firm at 2.75@2.80c. for tank, angles at 2.90@3c.; beams, 3.60c.; channels, 3.80c. Sheet iron is a shade weaker, owing to the falling off of requirements. Swedish and Norwegian iron are active; Russian, firm. Nails in car load lots, $3@ $3.05, with active demand in view. Plumbers' supplies quiet. Pig lead, 4.10c. The steel trade is backward and prices weak. Pig tin in fair demand at 21¾.

A number of inquiries for steel rails in small lots, are on hand, and prices are $40@$41. Concessions are made on inquiries for large lots. Anthracite irons have advanced 50c. All kinds of pig iron are in dull demand. Southern irons are in fair request. Prices of builders' hardware steady.